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THE SURGERY OF URETHRAL OBSTRUCTION.[1]

By R. J. SILVERTON,
Sydney.

THE old adage was "a stricture is never cured", but, to counterbalance that depressing maxim, surgical methods have improved and the incidence of inflammatory stricture has diminished. It has been said that it takes about twenty years, on an average, for an inflammatory stricture to manifest itself by obstruction, so, on this reckoning, we should about ten years from now see very little of this variety, owing to antibiotic therapy.

It is a different story with traumatic stricture. The primary effects of severe urethral injury may appear at once and secondary fibrotic effects in a month or two.

During periods of war there is a rapid increase of traumatic stricture so far as concerns urologists doing military work. On the civilian side there is a small, but continual, supply from occupational straddle and pelvic injuries, and the latter group is particularly implicated in motor-car accidents. With the great extension of industry and the increase in speed of motor vehicles, we are increasingly up against the problem of urethral obstruction, and must be prepared to deal with it in all parts of the canal.

[1] Read at a meeting of the Urological Society of Australasia on April 20 to 23, at Surfers' Paradise, Queensland.

As urologists, we usually have to deal with the secondary fibrotic effects of these injuries, but in public hospital practice the primary treatment is sometimes in our charge. Considering the modern development of our specialty, and the widespread publication of numerous articles on this subject, it is remarkable that, when a patient is sent to us for the care of the later problems in this sphere, the cystostomy that has been done urgently has, as a rule, been very badly done. Therefore we must still hammer in some teaching on this score.

It is my design, however, in this paper, to limit myself to the problems of secondary surgery, and I shall not take space to discuss the primary management after accidents. In the sections of this communication which deal with operative technique, I have elected to avoid watertight division of the discussion into the various surgical districts of the canal, and instead shall describe my current methods under technical headings, pointing out the variations of the technique required in the different parts of the urethra, so as to get immediate comparison.

Diagnosis.

In most cases, except those of severe deep urethral injury, a small to medium soft rubber catheter is passed gently just to test the point of blockage. Having determined a block, one usually changes at once to fine filiform bougies to test impassability or otherwise, and advances warily with primary dilatation.

After a while, provided the canal is opening up a little, urethrography is called for, and the injection should always be made by the urologist himself. Urethrography should not be carried out until one week has elapsed after the dilatation, nor should it be done before the lumen of the stricture has reached a calibre of at least 6 or 7F. If it is done soon after dilatation there may be present little splits in the mucosa; the medium is then easily forced into the veins and is carried to distant parts of the body, sometimes with serious results. If it is done while the calibre of the stricture is still very small and there is much resistance to the injection, the force of the latter may split the mucosa, again with urethro-venous reflux.

FIGURE I.

I have been guilty of causing such a reflux on two or three occasions, but no harm was done, for the formula I designed many years ago is non-oily and apparently non-toxic in the small amount of backflow that is likely to occur. An hour or two before the examination, the pharmacist makes up 40 mils of 10% sodium iodide in one in 8000 biniodide of mercury. This is brought to the consistency of moderately thick honey with glycerine of tragacanth. This is dispensed in a wide-mouth glass jar, into which the tip of the syringe can be inserted. No sterilizing is needed, just a warm water bath around the jar. This solution is non-irritating, non-toxic and adequately opaque after 20 mils of "Uropac" or other intravenous contrast medium have been stirred into it. If it is made up too long before use, a brownish colour appears, due to nascent iodide, which is irritating.

For the injection I use the catheter syringe which I designed a few years ago to facilitate the filling of Foley balloons and the evacuation of clots *et cetera* from the bladder. The nozzle makes it suitable as a urethral syringe in either sex, and it is quite handy and suitable for urethrograms. This instrument is made by Elliotts of Sydney and the G.U. Manufacturing Company of London. At full stretch it holds 25 mils, enough for each urethrographic injection. The latter is made in a slight lateral tilt to the right and to the left. The thigh on the side to which the patient is tilted is flexed and abducted, and the penis held stretched and parallel to that thigh. The X-ray tube is centred over the lower end of the *symphysis pubis*. Exposure is made during expulsion of the last few mils of the medium.

Dilatation.

This time-honoured method has various types of application, but with any there are limits to the degree of so-called cure obtainable. In the days when only dilatation or the urethrotomies were available the adage "a stricture is never cured" was nearly always correct, but with the modern method of complete removal of all fibrosed tissue or certain other necessarily modified methods short of the ideal the results have moved distinctly towards achieving the aim of complete cure.

Nevertheless, when a stricture responds quickly and generously to dilatation, and the intervals can be gradually lengthened until the patient has to attend only once a year or even less often, a cure, for all practical purposes, can be claimed. Unfortunately, only a small minority of cases will respond thus.

The usual gentle method is to fit the stricture and not to dilate it. The interval at first may be seven to fourteen days, designed to allow a natural reaction of opening-up of the canal and to avoid any irritation or actual damage to the wall of the urethra.

Other workers prefer quicker dilatation under anæsthesia, either with sounds or with a filiform guide screwed onto the conical tip of a plastic catheter follower. The latter is left in for a day, and then replaced by a rubber catheter, to be replaced daily by large catheters (continuous dilatation). This is a valuable method in some cases, but, as a general rule, I have not taken kindly to it.

FIGURE IIA.

Open Surgical Methods.

The ideal method is excision—that is, complete removal of all fibrotic tissue, with end-to-end anastomosis of the distal and proximal healthy segments. The fibrosis often effects the *corpus spongiosum* as well as the urethral wall itself, but, in any case, the essential first step of the operation is to separate the spongy body completely from its bed for some distance proximally and distally from the fibrosed district. This mobilization is fortunately done in a bloodless plane, and is applicable from the *fossa navicularis* to the urogenital diaphragm. In 1915, Hamilton Russell, of Melbourne, described an original operation for excision of strictures in any part of the bulbous, scrotal or penile portions. The urethra was laid open both proximal and distal to the stricture, the ends of the ribbon-like segments united and nothing more done except deep perineal drainage through the membrano-prostatic portion of the canal. It is an advantage to complete all this separation before the spongy body is incised and before the urethra is opened.

So far as the bulbous urethral obstructions are concerned, the proximal urethro-cavernous segment should be separated from its bed right back to the urogenital

diaphragm. The distance of separation of the distal segment will depend on the site of the stricture and on the length of the piece to be excised. The more proximal the stricture and the greater its length, the more distally will mobilization have to be done, and in some cases the scrotum will have to be split to allow adequate length of mobilization. The desideratum is, of course, that, after excision of the stricture, the two segments should come together without tension.

A very long stricture (over 3·5 centimetres) may preclude excision, and the method of intubated urethrotomy may have to be substituted, although many years ago the ingenious Hugh Young got over this difficulty by detaching the crura of the penis from their bony moorings and sliding them backwards to be fixed in a new position. This made the penis shorter, but did allow natural micturition. His paper was given the humorous title of: "A New Use for the Penis".

With external urethrotomy, all obvious fibrous tissue in the urethra itself and in the *corpus spongiosum* should be meticulously dissected away (cicatrectomy). In cases of multiple fistulæ of the perineum the whole mass of fibrosis, fistulæ and abscesses is ruthlessly removed, as well as any urethral and cavernous fibrosis.

FIGURE IIB.

In all these cicatrectomies, simple as well as complicated by fistulæ, the aim is to try to leave a continuous strip of mucosa along the roof of the urethra, even if this is a little fibrosed in places. However narrow the strip, if a splint, preferably a new Foley catheter, size 18F, is left in place for a fairly long period, four weeks or so, it acts as the nucleus for formation of a moderately wide urethral tube. We may fairly call this method "intubated urethrotomy" on the analogy of the D. M. Davis intubated ureterotomy.

In excision the urethro-cavernous tube is opened on a Wheelhouse staff by a longitudinal incision along its floor. This is made for any required distance, and a traction suture is passed through the thick wall on each side quite close to the stricture. The thick urethro-cavernous wall is cut boldly across, fairly near the stricture, but not too near, as its end must be broad, and not too tapering. We now dissect this thick strip up from its bed as far forward as is necessary.

The mass of fibrosed tissue is now dissected up, preferably in one piece which will be continuous with the healthy proximal segment. Since the latter has already been mobilized back to the urogenital diaphragm it should be easy to find its lumen, even if no guide is within, simply by cutting right across the segment near the end of the fibrosed tissue, or by making a short longitudinal opening along its floor.

Where a cystostomy is present, the incision may be made on the top of a Béniqué sound passed retrograde. Other-

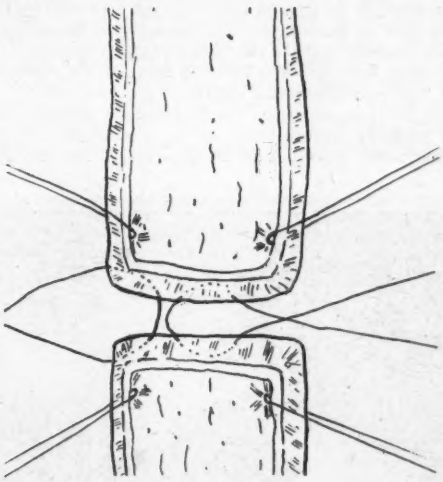

FIGURE III.

wise, if discovery of the proximal lumen is still difficult, pressure on the bladder may cause a few drops of urine to escape, or massage of the prostate and seminal vesicles will allow a little spermatic fluid to appear, as a guide to the proximal lumen.

FIGURE IVA.

In the penile urethra, mobilization and opening of the two segments is quite easy, proceeding on similar lines to the above.

With a stricture in the scrotal portion, it is better to split the scrotum, partially or wholly, to get good accessibility to the site of the disease. Neglect of this point in technique may lead to a defective result.

Both excision and urethrotomy are inapplicable to the membranous and prostatic portions of the urethra, and

here the necessary preliminary is a suprapubic cystostomy. This has often been done some time before as part of the urgent primary treatment. If the cystostomy is not a high, supple, well-made one, or if one's own cystostomy has been made a long time before, it is often very advantageous to dissect it out, and to remake it at the end of the operation, or to close the bladder, as preferred. If there is much fibrosis in the prostatic segment of the urethra it is far easier to manipulate the retrograde sound through the open bladder than down a suprapubic fistula. In the latter case it is obligatory to use a metal sound or catheter with a double, or Béniqué, curve.

As a rule, in these cases, the undamaged bulbous urethra (distal segment) comes right up to, or near, the urogenital diaphragm, and only has to be detached from any fibrosis

FIGURE IVB.

and then reattached to an artificial edge made on the pubic aspect of the membranous urethra when the latter has been cored out in the way shortly to be described. Should the distal segment be destroyed to any distance by fibrosis, the fibrosed length has to be resected and the urethra mobilized well forward into the scrotum, so that the now healthy distal segment can be brought back to the membranous urethra without tension.

Intermittent impulses are now made on the retrograde sound by an assistant, and the surgeon performs a series of small circular coring-out sweeps with the point of a narrow-bladed scalpel or bistoury. Great care must be taken when passing through the membranous urethra to keep to the region from which the distal segment was detached, and not to allow the diameter of the new canal to exceed 1·0 centimetre for fear of damaging the external sphincter. Proceeding deeper through the fibrosed prostate, one continues the coring-out manipulation, aiming all the time at the point of the intermittent impulses. In one case where practically the whole of the prostatic urethra was occluded I found that this method succeeded.

When the bistoury reaches the tip of the sound, the latter is pushed through to the perineum. After that, any further coring-out, as well as full dilatation, is done to secure a canal through the prostate of nearly 1·0 centimetre diameter. One cannot be sure that one is always exactly in the line of the former prostatic urethra, but nevertheless the new canal becomes epithelialized, provided it is splinted for a sufficiently long time.

A 20 or 22F St. Peter's tube or catheter is passed along the anterior segment of the urethra from the external meatus. If it is an ordinary catheter, its tip is cut off, and a terminal eye is left, while a lateral eye is cut in it near the tip. The catheter is fitted tightly over the tip of a retrograde sound of proper size, and withdrawn into the bladder, and thence out through the abdominal wound. Here a silk thread is passed through its tip. The catheter is then pulled back so that it lies on the bladder floor. The silk loop is secured to a glass rod on the abdominal surface, and the bladder closed, or the cystostomy continued, as preferred.

Further retention of the cystostomy is a conservative measure in the case of failure of the newly-cored canal to remain adequately open. When the urethral splint is removed at the end of one month or so, one can spigot the cystostomy tube and try out natural urination for a few days. If it is not satisfactory, one can reopen the bulbous urethra and core out the membranous and prostatic portions a little more widely.

End-to-End Anastomosis.

End-to-end anastomosis is done, not as cylinder to cylinder, but as strap to strap. After junction, the continuous strap, having been dissected up from its bed, tends to resume its original cylindrical form when the patient's lower limbs come together. This applies to the scrotal and perineal portions.

The most important technical point in anastomosis is first of all to join the cavernous layers with strong durable, or semi-durable, sutures. It is understood that there is little or no tension after adequate mobilization of the segments; nevertheless the basis of junction should be lasting, strong sutures for the thick, spongy layer, and fine absorbable plain gut for the mucosal layer. The former is not exposed to urine, the latter is.

FIGURE VA.

For the deep sutures my preference is thirty-day chromicized gut, fairly thick, about size 0 or even 1. I use three mattress sutures, placed transversely instead of longitudinally, and all taking a thick, deep bite, not penetrating the mucosa. An ordinary small half-circle needle is used, and the middle suture is placed and tied first, then the two laterals (Figure III).

If this important line of sutures is properly placed, one should see the mucosal layers of the straps come neatly into apposition, with just a little pouting gap here and there. These are closed with fine plain catgut interrupted sutures on an atraumatic needle, so as to make a watertight covering up of the deeper, or cavernous, layer. The whole strength of the anastomosis is in the efficient and strong suturing of the *corpus spongiosum*.

In the penile urethra the urethro-cavernous cylinder is closed by placing interrupted plain catgut sutures of medium size at close intervals along its floor. These

sutures should just miss the mucosa, but their effect, all the same, is to bring the mucosal edges into apposition. If they catch the mucosa they seem to diminish overmuch the calibre of the penile urethra.

The penile urethra must be closed. It is so close to the skin that a fistula would almost certainly form if it was left open. Therefore, over the closed urethro-cavernous cylinder the subcutaneous tissues are brought together in two layers, and then the skin. The question of splinting and of urine diversion is considered in the next section.

In the bulbous and perineal portions there is thick tissue superficial to the urethra, and complete closure entails the risk of pocketing, infection and periurethral infiltration, with much local after-trouble and even secondary blockage of the stream. I have always found that the best and quickest results are obtained by leaving the urethra and overlying tissues as widely open as one can, except perhaps for a short distance distally, but never proximally.

Splinting and Deviation.

Splinting and deviation are well considered together. After penile excision the most convenient and most efficient deviation is by bulbous urethrostomy. One should use an 18 or 20F new Foley retention catheter, left in place for about ten days, then one should remove it and

FIGURE Vb.

allow natural urination. For a little while a small amount of urine may leak perineally, but the urostomy will rapidly close if the penile urethra is patent.

Even if a preliminary cystostomy has previously been established, I still think it is better to use perineal deviation, for this acts as a plug as well as a drain, and the occasional passage of urine along the urethra which can occur with cystostomy is avoided. Moreover, the suprapubic fistula can be curetted at the time of operation and the opening firmly strapped over. Before the perineal drain is removed, the suprapubic fistula will be healed.

No splint should be used after excision in the penile portion. The urethra looks very narrow after its closure, and a splint would cause pressure and therefore urethritic reaction, with an adverse effect on the anastomosis.

Conditions are different in the scrotal and perineal portions. Here the urethra is left widely open, and there is little pressure when a splint is left in. Moreover, the latter can be wide enough to act as a drain, provided it is composed of "Latex", which causes so little urethritic reaction. I therefore use an 18F new Foley retention catheter, leaving it in place for ten days or a little longer, according to the state of healing of the perineal wound. Formerly, I used a perineal urethrostomy placed proximally to the anastomosis, if there was room for it, but I have found that the urethral drain gives even better results.

In the posterior urethra, after the coring-out operation, the splint must be retained for a long time. I have used only red rubber tubes, retained by silk loops to the abdominal wall, but "Latex" catheters with bevelled terminal eye would be very useful. They have not appeared on the Australian market, so far as I know. Such catheters would also be ideal for urethral drainage after

FIGURE VIa.

prostatectomy. If one prefers, the cystostomy fistula can be curetted, or the bladder wall completely closed at open dissection, at the time of the deep urethral operation, provided one has confidence in the draining capacity of the urethral splint, and provided it lies in the proper position on the bladder floor. This splint must be retained for a minimum period of four weeks to allow epithelialization to spread along the new canal from the urethral and vesical ends. There is no harm in making the splinting period a week or two longer.

After-Treatment.

One should see the patient about two weeks after urination has been reestablished, for the gentle passage of a fine soft catheter. If this instrument catches in a fold, or is otherwise blocked, it is sometimes safer to pass, with extreme care, very small curved metal sounds, for one can direct the point better. At this stage, ordinary plastic urethral bougies are perhaps not safe, for the point is apt to catch in irregularities of the surface. No further testing should be done at this sitting.

After this, if urination is satisfactory, the intervals can be doubled, and later dilatation made more searching. If the result is good, it means that it is not very long before the patient has to attend only once a year. After two or three years of this he can be pronounced as virtually cured, but I generally say that one can never be quite sure, and suggest a five-year check.

Where the results are not perfect, dilatation at intervals must be judged according to the special conditions of each

case, but some patients are content, even if they have to attend two or three times per year.

When the result seems to be unsatisfactory, a check urethrogram is called for, and reexcision if necessary.

Alternative Technical Methods.

A few years ago Mr. G. H. Burnell demonstrated to this Society a most successful result in a case of congenital shortening of the urethro-cavernous cylinder in the penile portion, with disabling downward chordee on erection. After transverse incision of the cylinder, and straightening of the organ, a long gap was left, and this Mr. Burnell filled with a free, whole-thickness, tubular graft inserted on a catheter. The method has been written about in the past, but I have not noticed references to its use in the literature of the past ten years or so. However, in the

FIGURE VIB.

1950 "Year Book of Urology" the editor (W. W. Scott) inserts a footnote to an article on stricture, and this reads as follows:

> A series of patients with intractable urethral stricture, treated in the Brady Urological Institute, Baltimore, by urethral excision and reconstruction of a new urethra with split-thickness skin grafts, have in the main done poorly, suffering recurrence and fistulæ. Even though in one or two cases, results are encouraging, the problem of severe, recurrent, inflammatory stricture is not yet solved.

One notes that the free grafts were split-thickness, and not whole-thickness. I do not know if that makes any essential difference.

A. W. Badenoch, of London, created in 1950 a deal of interest with his "pull through" operation for relining the cored-out posterior urethra with epithelium. The distal urethra was pulled through as an intact cylinder, after mobilization. He does not state clearly whether the thin urethral wall alone, or the whole thick urethro-cavernous cylinder is pulled through.

Badenoch's analysis of the five cases on which he bases his paper is not impressive. Two of the operations failed and had to be repeated. Only one case could be claimed as a cure, and in all cases the details given were extremely sketchy.

However, the same method, together with an interesting addition, had been published nine years earlier, in 1941, by Charles Wells, of Liverpool, without possessing the dramatic headline title of "pull through". He freed the urethral tube from fibrosis at or near the membranous

FIGURE VII.

urethra by transverse incision, but here again we are in doubt whether the urethra alone is meant. A suture is passed through the end of the urethral wall and is attached to the tip of a retrograde sound, which is withdrawn out of the suprapubic fistula. One hopes that the posterior urethra is relined to the extent of one and a half inches or even

FIGURE VIIIA.

right up to the internal meatus. The suture is attached to an elastic band sutured to the skin near one anterior superior iliac spine. It is of plain catgut, and when its slight tension causes it to cut through the urethral wall it is judged that the latter has adhered efficiently to its new bed.

When fibrosis extends distally along the bulbous urethra, Wells makes an ingenious flap from the floor of the canal

to give more length for the relining of the posterior urethra.

This article can be consulted for technical details, but I know from personal experience that simple attachment of the mobilized distal segment to the edge of the newly

FIGURE VIIIB.

cored-out membranous urethra and fairly long splinting will give a good result, and interfere less with the viability of the urethral wall.

Finally, I may quote Mr. Badenoch's rather defeatist concluding statement as significant. He says: "The alternative to this operation is a permanent suprapubic fistula, or

FIGURE IX.

transplantation of the ureters into the bowel." An adequately wide coring-out and patient splinting is an easy means of avoiding this comparatively horrible fate.

A method of "by-passing" a strictured portion of bulbous urethra was advocated in 1941 by F. MacG. Loughnane. This is really an extreme simplification of the usual external urethrotomy operation by which the distal segment is opened just in front of the stricture on a grooved staff, and the proximal segment just behind it on a retrograde sound, a preliminary cystostomy having been established. A rubber tube of convenient size is passed along the distal segment and out through the urethrotomy opening. It is fitted tightly over the end of a retrograde sound which emerges from the proximal urethrotomy opening, and drawn back into the bladder and out through the suprapubic fistula.

This long piece of tubing has no side holes in it, so the cystostomy drainage is continued, and it is hoped that the long splint will be surrounded in its new perineal passage by epithelium growing from both urethral segments. The patient is allowed to move the tube back and forth occasionally, and this, it is hoped, will accelerate epithelialization. Satisfactory results were claimed. I have not attempted this method.

FIGURE XA.

Finally, there is the method recently described (1952) by John Swinney, of Newcastle-on-Tyne. He proposes the use of a mid-line strip of skin, which is buried in the manner of a Denis Browne hypospadias operation. An essential is a preliminary cystostomy. All fibrosed urethra and contiguous unhealthy tissue is ruthlessly removed, and the skin edges are brought together over this dissected area. Each end of the urethra is left open on to the skin.

A long interval is allowed for disappearance of all infiltration, and then a skin strip is outlined between the two urostomy openings, and including them. The skin on each side is then mobilized and drawn together over the isolated strip, and sutured in the Denis Browne manner. If the penile portion is the site of the operation, a free dorsal relieving incision is necessary.

In a few cases described, nearly one-half of the operations were not done by the use of a skin strip, but by leaving a strip of the roof of the urethra. This in itself is not a new method, but, instead of leaving the perineum open, it is closed at once, and Swinney claims that tubular formation follows. There is a cystostomy drain, but no splint.

This sounds interesting, and may be valuable, but the whole duration of treatment is very lengthened when done in two stages, with allowance for softening of tissues in between.

In one of the cases where no skin strip at all was used, Swinney did an ordinary stricture excision, with end-to-end anastomosis, leaving the resulting strip open and flat in the usual manner, but closing the tissues and skin over it at once. The result was good. This is very interesting and should be a valuable method if it can be repeated successfully. I confess that I should be afraid of pocketing and other troubles in the loose perineal or scrotal tissues, especially if the patient was seized by one of those frequent spasmodic urges, or if the cystostomy tube became blocked temporarily and the patient tried to micturate down the channel.

FIGURE XB.

Case Reports.

The following reports are a few selected ones only; they are designed to explain the illustrations in this paper.

Case I.

A.T., aged fifty-eight years, was sent to me at the 113 A.G.H. in August, 1944, with a cystostomy which had been done for retention due to an impassable stricture in the very deepest part of the bulbous urethra. My attempt to pass bougies and then small metal sounds caused slight bleeding. I then proceeded, very unwisely, to make a urethrogram. This caused bright bleeding, so I refrained from making a second exposure in the opposite tilt.

The urethrogram shows a sudden and complete block at the juxtamembranous part of the bulbous urethra with a urethro-venous reflex. Behind the pubis the dorsal vein of the penis can be seen (Figure I). Intubated external urethrotomy was successful.

Case II.

A.H., aged twenty-five years, seen in April, 1945, at 113 A.G.H., had a severe obstruction about the mid-bulb. I attempted a urethrogram primarily, that is, without previous dilatation with bougies. The first injection caused pain followed by bleeding, so the exposure in the opposite tilt was not made.

The urethrogram showed an annular type of stricture, with an oval pool of extravasation spreading from it into the tissues of the perineum. Caverns and sinuses are seen running into the prostate gland (Figure IIA).

Next day the perineum was opened up and only bruising was seen on the site of extravasation. The stricture was excised completely, with end-to-end anastomosis of the healthy segments, and the result, tested a few months later, was good (Figure IIB).

Case III.

W.G.U., aged sixty-seven years, was seen in private practice in September, 1940, with a very small trilobed adenoma of the prostate, which I treated by endoscopic per-urethral resection. This report illustrates stricture of the penile urethra, in this case traumatic, being caused by the

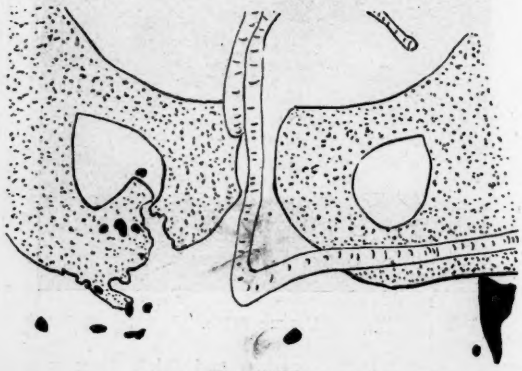

FIGURE XIA.

resectoscope itself. He did well for about one year and then returned with some restriction of the stream and increased frequency. A medium catheter blocked at about two and a half inches down the canal.

He got along fairly well for three years with an occasional dilatation, but not very well, so I made a urethrogram which shows a moderately narrow stricture of the penile urethra (Figure IVA). The stricture is seen to be about three millimetres long. Complete excision was an easy operation. Perineal deviation of urine was achieved by a bulbous urethrostomy for ten days.

A check urethrogram is here illustrated. It was made about one year after operation, and shows a widely open penile urethra (Figure IVB).

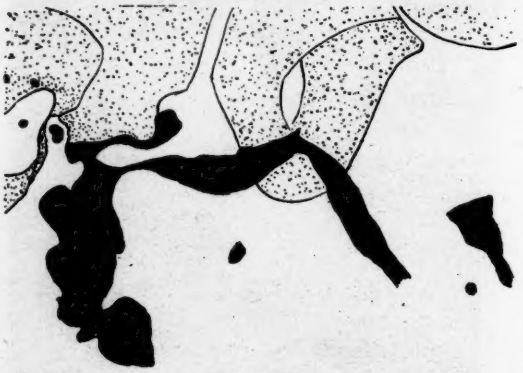

FIGURE XIB.

Case IV.

B.C., aged fifty years, illustrates the treatment of stricture of the mid-bulb by excision. He had a tendency to retention and was seen by me at 113 A.G.H. in December, 1944. The pre-operative urethrogram shows the stricture clearly; it is tortuous and very narrow and is about seven millimetres long (Figure VA).

Excision was carried out, and end-to-end anastomosis was done by the improved method of suture in two layers described in the text. The result was perfect, as seen by the post-operative urethrogram made about six months later (Figure VB).

Case V.

C.B., aged sixty-seven years, was seen at the Royal North Shore Hospital in May, 1942, with retention. The urethrogram shows a long irregular, narrow-calibre stricture of the bulbous urethra (Figure VIA).

A preliminary cystostomy having been done for the retention, complete excision of the long stricture was later performed. The anastomosis was done in only one layer, and, since there was a cystostomy, no catheter was left in the urethra. The floor of the perineum was left widely open.

As tested four months later, the result was not good, since only fine filiform bougies would pass. He was actually passing a good stream in spite of our inability to dilate the canal.

In December, 1942, a second excision was done. The segments were found separated, but this time they were anastomosed in two layers, and deviation was by perineal urethrostomy proximal to the line of anastomosis.

At a check in February, 1943, large sounds could be passed, and in June, 1943, the post-operative urethrogram showed a patent canal all through (Figure VIB).

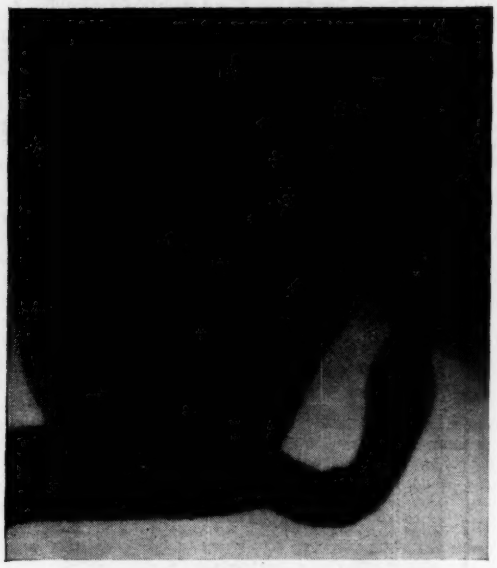

FIGURE XIC.

Case VI.

V.H.A., aged twenty years, was seen in October, 1941, at 113 A.G.H. with a urethral fistula (leaking urine) in the perineum, resulting from the passage of a 22-gauge bullet which lodged in the prevesical space. He had continual incontinence of urine.

The urethrogram shows a stricture of the mid-bulbous urethra with an extensive fistula running down to the perineum, and the lodged bullet (Figure VII).

A week later, suprapubic cystostomy was done, the bullet removed from the prevesical space and a plastic tightening done on the internal sphincter, which was found to be relaxed, probably owing to some disturbance from the bullet's passage.

A month later the stricture was excised, and all seemed very satisfactory, anastomosis being made in one layer. However, the urethra did not remain well open afterwards, and in June, 1942, the cystostomy was reestablished, and two weeks later the stricture reexcised. The segments were found to be about one inch apart, and they were anastomosed by five plain catgut one-layer sutures, with deeply placed tension sutures attaching the outer aspect of the spongy body to deeper tissues.

The primary result, for a month or so, was good, but after that, for three and a half years, his stream was never really satisfactory and he returned in January, 1946, for further treatment. I now used the improved technique of anastomosis in two layers, chromicized gut for the spongy body, plain gut for the urethral wall, deviation being through the deep part of the bulbous urethra.

The result was good, and a check urethrogram made in March, 1946, which is unfortunately not available for publication, showed a widely open canal.

Case VII.

E.A.B., aged fifty-six years, was seen in private practice in January, 1945, with a history of straddle injury to the bulbous urethra when a boy. This history seemed a little doubtful, and a more likely source was a purulent urethritis at twenty years of age.

The stream had gradually become poorer for some years past, with more or less regular dilatation. He recently developed an abscess in the front of the scrotum, leaving many fistulæ distal to, through and proximal to the scrotum.

The urethrogram shows clearly a narrowed lumen for four to five centimetres of the bulbous urethra, with fistulæ over a wide extent and sinuses in the perineal tissues (Figure VIIIA).

On February 25 I established a suprapubic cystostomy, with excision of the huge mass of fistulæ and abscesses and intubated urethrotomy about two weeks later. The incision was a long double (fusiform) one, outlining the whole indurated mass, and extending from the peno-scrotal junction right through the scrotum back almost to the anus. A thin strip of urethral roof was left untouched. The wound, including the split scrotum, was left open and completely unsutured. A Foley 18F "Latex" balloon catheter was left in for two weeks.

The result was good, as shown by the post-operative urethrogram (Figure VIIIB).

Case VIII.

C.C., aged sixty years, was seen in private practice in March, 1946, with a complaint of a very poor stream recently, the history of restricted stream having gone back for ten years. I could palpate a hard mass in the perineum behind the point where a catheter was blocked, that is, in the anterior part of the perineum, actually partly in the scrotal portion.

I foolishly omitted to have a plain X-ray photograph taken just before the urethrogram, otherwise I would have shown up the calculi which filled a large diverticulum of the bulbous urethra. This is a rare finding in the male, though such sacs are occasionally seen in the female urethra.

The urethrogram shows clearly the interruption to the urethral canal at the point of the blockage, with an irregular, unhealthy canal behind it, and a diverticulum of quite a large size running down into the perineum (Figure IX).

I did not do a preliminary cystostomy, but proceeded at the end of May to an external urethrotomy. The perineum was opened with a long incision, and the diverticulum, which was full of small facetted calculi, together with a lot of fibrous tissue, was completely excised. A fairly wide strip of urethral roof was left, and the whole wound was left open. Drainage was for three weeks by means of an 18F Foley indwelling catheter.

Healing was a little slow, probably on account of diabetes. This was cared for by Dr. W. W. Ingram. The patient urinated well on removal of the catheter. He left hospital with a dressing on the perineum, and the wound closed completely two weeks later.

When he was seen three months later, medium sounds passed easily. Further follow-up was impossible as he failed to return, saying that he was perfectly well and did not desire more sounding.

Case IX.

E.L., aged twenty-five years, was seen by me at the 113 A.G.H. in February, 1942. He had suffered multiple shrapnel wounds of both pubic bones and the left ischium. The pubes had been badly smashed and there was a good deal of infection. Bare bone was exposed in the open wound over the left ischial tuberosity.

He had had a suprapubic cystostomy established, and an orthopædic surgeon spent several months cleaning up the wounded area before I could attend to him.

My first urethrogram shows clearly a complete block in the deep part of the bulbous urethra (Figure XA).

Early in June I excised the suprapubic fistula and remade the cystostomy. I tried to pass a sound retrograde through the posterior urethra while I had the bladder open, but it would penetrate the canal for only about half an inch.

The bulbous urethra was opened up in the perineum, all the fibrosed proximal part of the bulb was excised, and the posterior urethra was cored out in the manner described in the text of this paper. The bulbous urethra was mobilized

and brought up to make the contact with the membranous urethra. A urethral splint, as well as the cystostomy, was retained for one month.

In the middle of July, urinary function was good, and the canal allowed passage of moderately large sounds. At the end of July a urethrogram revealed a patent canal throughout. It will be noticed that the normal anatomy of the posterior urethra is remarkably well restored, considering that the coring-out operation has to be done blindly (Figure XIB).

FIGURE XIIA.

The patient was an American soldier, and soon after this was evacuated to his homeland, so I did not have the chance to make a remote check in this interesting case.

Case X.

J.C.C., aged nineteen years, was first seen by me during an operation by Colonel V. M. Coppleson at the 113 A.G.H. in April, 1942. There was a large hole in the perineum, filled with most offensive urine and fæces. He had sustained a severe wound by a service bullet, which tore away part of the anal canal and lower part of the rectum as well as part of the bulbous and deep urethral segments. A cystostomy and colostomy had previously been established, and a rubber catheter was seen traversing the hole in the perineum for several inches. The rectum and anal canal were sutured, but no attempt could be made to restore the urethra until much later when all sepsis had been conquered.

The early plain skiagram was mislaid, but fortunately I had made a tracing of this film, and it is reproduced in Figure XIA. The bullet, with many fragments of "bullet dust", is seen, as well as the smashed-up right ischium. The catheter is seen in position, as well as the cystostomy tube.

In June, 1942, the perineum and anus were healed, except for a fistulous opening in the angle between the perineum and the right thigh. A urethrogram made at this time (when a catheter would no longer pass into the bladder) shows the medium blocking at the region of the deepest part of the bulb, but going down to fill a large fistulous pool on the right side in the perineum (Figure XIB).

Early in September the rectum and anal canal were well healed, with fairly good continence of fæces, and the colostomy was partly closed.

In October I excised and remade the suprapubic fistula, which was adherent to the pubis. At the same sitting I opened the bulbous urethra through the perineum and excised all the fibrosed proximal part of this portion of the canal. With a sound passed retrograde into the posterior portion of the urethra I was able to core out the fibrosed membranous portion and the fibrosed distal portion of the prostatic urethra. The bulbous urethra was well mobilized by dissecting around the investing *corpus cavernosum* right to the scrotum and the bulbous portion was then sutured to an artificial edge of tissue on the pubic aspect of the membranous portion.

An 18F splint through the whole urethra was retained for five weeks. He did well, and the passage was dilated at increasing intervals. Six months after the operation a urethrogram showed a good result. Sounds were passed satisfactorily at six and later twelve months intervals.

The urethrogram made early in 1945 shows an excellent passage all through the posterior portion of the urethra (Figure XIc). This picture was made two years after a dilatation, so the patient was considered cured.

Case XI.

N.B., aged twenty-one years, provides a very severe example of complete rupture of the most distal part of the prostatic urethra, with severe upward dislocation of the prostate and bladder. I saw this lad in October, 1942, during his early treatment for pelvic crush injury by Colonel V. M. Coppleson at 113 A.G.H. He had been run over by a three-ton truck. At the original operation Colonel Coppleson pushed the dislocated prostate and bladder downwards and got a catheter through the urethra into the bladder. Later, the catheter could not be reinserted when it came out.

I made a urethrogram (Figure XIIA) which shows the bulbous urethra coming to a complete and sudden stop, without any tapering, just about the region of the membranous urethra.

FIGURE XIIB.

On October 30 the suprapubic fistula (tacked down on the pubis) was excised, and the cystostomy remade. It was noted that a curved sound would only pass into the posterior urethra for two centimetres.

Three weeks later the bulbous urethra was opened from the perineum, and it was found to go back to the membranous portion, so no excision of tissue and no mobilization had to be done.

A double-curved metal Bêniqué sound was passed retrograde into the posterior urethra, but its tip could not be felt, only its impulses indirectly. However, the coring-out operation was done in the general direction of the impulses and the tip of the sound was reached. A catheter was left indwelling.

A check urethrogram in March, 1943, showed a good canal through the posterior urethra. In April, 1943, curved sounds would not pass, but quite large rubber coudé catheters went through easily. However, after this I managed to dilate the whole canal with curved metal sounds by expedient of one forefinger in the anal canal as a guide to help the sound tip through the distorted posterior urethra. The passage was dilated at increasing intervals up to early 1945 when moderately large sounds would pass.

A check urethrogram at this time (Figure XIIb) shows a serviceably open canal all through. At the middle of 1949 the patient was discharged as cured, but told to return in five years to be on the safe side.

Analysis of Cases.

The following is an analysis of my cases.

Total number of cases	107
Ætiology.	
Inflammatory	65
Traumatic	45
Doubtful	7
Site.	
Penile portion	9
Scrotal portion	3
Peno-scrotal portion	4
Perineal (bulbous) portion	72
Membranous portion	12
Membranous and posterior urethra	2
Posterior urethra	5
Operation.	
Dilatation only	33
Excision	36
Internal urethrotomy	3
External urethrotomy with cicatrectomy	16
External urethrotomy with excision of fistula	7
Coring-out operation	12
Result.	
Good	74
Fair	14
Failed—reoperation with good result	4
Failed—reoperation with fair result	2
Poor result	2
Result not determined	10
Not completed yet	1

Summary.

In this paper I have endeavoured to explain the technical principles on which I have relied in restoring the continuity of the male urethral canal, in its different parts, when blocked by fibrosis.

As the work progressed, methods which did not give, more or less consistently, a good result were discarded, and surer methods adopted.

In any part of the anterior urethra, mobilization of the urethro-cavernous cylinder is the essential before the canal is actually opened, when excision is contemplated.

After the opening, the obstructing mass is dealt with ideally by excision, or short of that by external urethrotomy with removal of all associated fibrosis.

End-to-end anastomosis, after excision, is most surely accomplished in two layers: (*a*) the cavernous layer with strong, durable sutures and (*b*) the urethral wall with a few fine, absorbable sutures.

In the penile portion, the urethra must be closed along the floor, and no splint retained. Elsewhere in the anterior part of the urethra not only the urethro-cavernous cylinder, but all the perineal (or scrotal) tissues that have been incised, are left widely open. The tissues being open, there is no pressure on the anastomotic line if a draining splint is retained; this is preferably a "Latex" balloon catheter. Alternatively, no splint need be used, and the urine is diverted by a urethrostomy drain through the bulbous urethra proximal to the site of anastomosis.

All the external urethrotomy procedures partake of the nature of an intubated urethrotomy, with a "Latex" balloon catheter retained for a fairly long period as a draining splint.

Fibrosis in the membranous and prostatic portions is managed by preliminary cystostomy, and a coring-out type of operation is performed.

A draining splint is retained for a long period to allow reepithelialization.

The cystostomy may, or may not, be retained also for a while.

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CYSTOURETHROGRAPHY IN THE MALE.[1][2]

By BASIL M. DE LAMBERT and NORMAN F. GREENSLADE,
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THE technique of cystourethrography has been developed chiefly by Scandinavian workers and finds little mention in English and American journals and text-books. We have used it over the last two years as a supplement to ordinary clinical investigation of genito-urinary cases, and have found it of considerable value.

Technique.

The technique used has been based on that developed by Edling[3] of the Caroline Hospital, Stockholm, and described in his thesis and subsequent articles. The technique was studied at first hand by one of us at the Caroline Hospital, and its value, safety and simplicity were evident.

Considerable advantages arise from the use of low density water-soluble contrast media, high output X-ray apparatus and efficient Potter-Bucky and wafer grids.

FIGURE I.

Normal oblique films: (*a*) during injection; (*b*) during micturition.

Contrast Media.

For contrast media we have used 7·5% sodium iodide solution, or 12% "Diodone" solution or "Iodoxyl" in sterile water, and up to 200 cubic centimetres have been employed for the examination. None of these solutions has proved irritating, and we have not found it necessary to use a local anæsthetic. This is the only respect in which our technique differs from that of Edling. Lipiodol was used on only one occasion and then to demonstrate the course of a small perineal fistula.

Apparatus.

The only special apparatus required is some means of gaining a water-tight junction at the penile meatus, and a 50-cubic centimetre syringe and connexions. Knuttson's instrument, as illustrated in Edling's publication, is ideal, and a copy is readily made up by a hospital instrument maker, an ordinary Spencer-Wells forceps being used as a basis. The essentials are a metal tube 18 inches in length with tap connected to the syringe and tipped with a soft rubber nozzle. Two hinged arms grip behind the glans

[1] Read at a meeting of the Urological Society of Australasia on April 20 to 23, at Surfers' Paradise, Queensland.

[2] This paper is based on subject matter in a paper read at the annual meeting of the College of Radiologists (Australia and New Zealand) on October 17, 1952.

[3] *Acta radiologica*, Supplementum LVIII; Volume 29, fascicle 6; Volume 30, fascicles 1 and 2; Volume 31, fascicle 2; Volume 32, fascicle 1.

with a ratchet or tightening screw for fixation. A vertical post at the hinge takes the tube.

Radiography.

A preliminary film is taken after the patient has emptied the bladder. Films during injection are as a routine measure taken in the antero-posterior position and in each

FIGURE II.
Injection and micturition films of a patient with traumatic urethral stricture on suprapubic drainage.

45° oblique position. The antero-posterior film is taken with 15° tube tilt to the feet as for the preliminary film, and one of the oblique films is taken with a 10° tube tilt towards the head. These films are taken during the course of injection as the last 10 of each 50 cubic centimetres runs in.

FIGURE III.
Micturition films before and after endoscopic resection of the bladder neck in a case of moderate trilobar enlargement, showing the excellent functional result.

A micturition film, an essential part of the examination, is taken after the bladder has been filled, in the same position as one of the injection films. Where possible these are taken with the patient recumbent, but in about one-third of the cases the patient is unable to micturate lying down and the film is taken with the patient in an equivalent position erect, by means of a Lysholm grid and film in a conventional chest stand.

A convenient centring point for all projections is the *symphysis pubis*. Inspection of the wet films will allow taking further views in appropriate positions, or at stages of filling or emptying of the bladder when necessary. The examination can be done single-handed, but more conveniently with an assistant, and takes from fifteen to twenty-five minutes from start to finish, including wet-film inspection and supplementary films.

Contraindications.

Recent instrumentation of the urethra with anything other than a small, soft catheter should lead to postponement of the examination for a period depending on the procedure. Simple urethroscopy and cystoscopy without trauma require a delay of four to five days. After dilatation of a stricture, the procedure should be deferred for ten to fourteen days. Acute infections of the urethra and bladder are contraindications, and a history of iodine sensitivity necessitates the usual precautions.

Complications.

The examination is, as a rule, completely painless. There may be some stinging in the urethra if there has been recent instrumentation. Small periurethral extravasations of contrast medium have occasionally occurred, but no harm has resulted. Infection could conceivably be introduced into the bladder and urethra, but has not occurred with us, and careful technique should eliminate this risk.

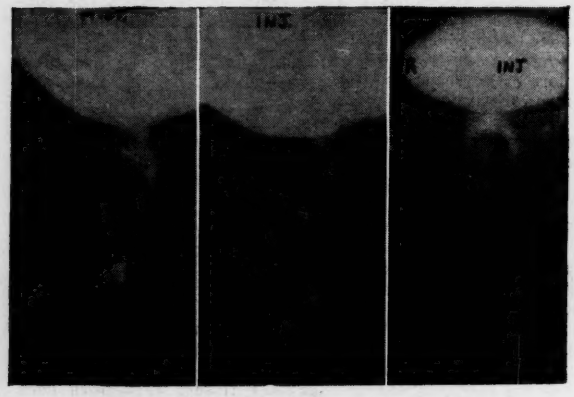

FIGURE IV.
Injection and micturition films three years after endoscopic resection, showing adenomatous regrowth in punch cavity.

Protection.

Unnecessary exposures and repeated examinations should be avoided, particularly in young people. On no account should the examiner's hands come in the direct beam. Use of the long connecting tube on the syringe and of the appropriate primary diaphragm or cone makes this condition easy to observe. A split lead-rubber sheet hung between the patient and the examiner protects him from scattered radiation.

Experience with the Method.

Over the last two years we have used the method in about 100 cases, most of these for diagnostic purposes, but some, in the early stages, to study the normal postoperative anatomy and physiology following retropubic prostatectomy and to aid in the interpretation of abnormalities.

Normal Findings.

Illustrated in Figure I are oblique films from a normal subject during injection and micturition. Points to note in the injection film are the relatively small posterior urethral lumen due to muscular tone. The colliculus, or verumontanum, is faintly seen and is a useful landmark;

the base of the bladder is flat, and there is no residual urine. On the micturition film the bladder shows normal contours and evidence of tone. The base of the bladder has descended, and the bladder neck with the posterior part of the urethra has opened out. The colliculus is again seen. There is a slight indentation inconstantly seen at the site of the triangular ligament. The anterior part of the urethra is of a normal calibre for micturition.

Anterior Urethral Strictures.

Anterior urethral strictures provide one of the main indications for the examination. The patient illustrated in Figure II, a man, aged twenty-eight years, had eight years before had severe perineal trauma followed by hæmaturia. He fell astride a beam. He had increasing difficulty with micturition until complete obstruction occurred four weeks before the examination. The stricture was dilated, but a perineal extravasation developed and suprapubic drainage was instituted. At the time of the examination he had improving function with a fair stream. The suprapubic de Pezzer catheter is seen and also the stricture in the posterior part of the urethra. During micturition the dilatation of the posterior part of the urethra proximal to the stricture is well seen. (Compare with Figure I (*b*).)

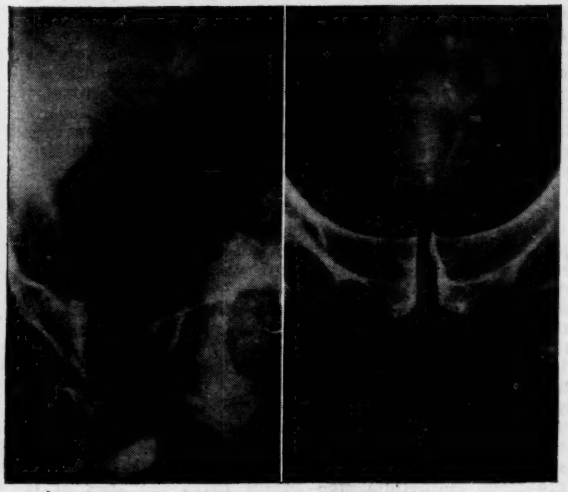

FIGURE V.

Injection films—antero-posterior and oblique—in a patient with gross adenomatous enlargement of the prostate.

Note also the filling of Cowper's ducts and glands. Micturition films in these cases often provided significant additional information, such as the degree of obstruction to micturition, the presence of more than one stricture, or the presence of bladder-neck fibrosis and median bar formation proximal to a stricture of long duration. The method is in these ways superior to ordinary routine urethrography, in which injection films alone are taken. Cases illustrating all these points have been encountered, although not all are illustrated here.

Prostatic and Posterior Urethral Conditions.

We have not used the examination as a routine procedure in cases of prostatic hypertrophy or carcinoma in which the diagnosis and line of treatment to be pursued were readily assessed by standard clinical methods, but have rather reserved it for atypical cases, and for those in which there were prostatic symptoms and small prostates, post-operative complications and dysfunctions. However, the method is a useful supplement to the usual clinical methods in routine cases, and will help in estimating the size and weight of the prostate and its suitability for retropubic, suprapubic or endoscopic resection. It is also useful in the investigation of the very large, soft prostate, in which cystoscopic examination may be impossible or inadvisable on account of possible trauma.

Illustrated in Figure III are the micturition films of a patient before and after endoscopic resection for moderate trilobar enlargement. The excellent functional result from this limited resection is well illustrated.

In Figure IV are injection and micturition films of a patient examined three years after endoscopic resection,

FIGURE VI.

Case with cystic swelling in ischio-rectal fossa communicating with prostatic cavities. Swelling injected with "Diodone", and urethrogram taken simultaneously.

with return of symptoms. Adenomatous regrowths in the punch cavity are clearly demonstrated, and resection of these again relieved the symptoms. The examination also shows the presence of a stricture in the bulb.

To illustrate the value of the method in assessing prostatic size, Figure V shows the injection films, antero-posterior and oblique, of a patient who was thought on

FIGURE VII.

Attempted micturition in a case of atonic bladder.

clinical examination to have only moderate enlargement of the prostate. The prostate is shown to project well into the bladder and to have considerable trilobar enlargement. Note how the posterior urethral stream is split into anterior and posterior parts as a result of touching of the greatly enlarged antero-lateral lobes in the slit-like lumen.

A case of particular interest is illustrated in Figure VI.

The patient is a man, aged seventy years, who first presented two years ago with pain near the anus of two months' duration and a lump in this region of six months' duration. He had been constipated and found that his bowels tended to move when he passed urine. He had prostatic symptoms of two years' duration and had lost one stone in weight during the last year. Clinical examination of the patient revealed a firm but slightly fluctuant swelling in the left ischio-rectal fossa, which also could be felt *per rectum* and seemed to be two inches in diameter. Aspiration of this swelling revealed blood-stained fluid, which was replaced with 35% "Diodone" solution. A urethrogram taken at the same time shows the relation of the rather distorted posterior part of the urethra to the large cavity in the ischio-rectal fossa and smaller communicating cavities apparently in the prostatic substance. At open operation the region of the bladder neck was hard and fixed, the trigone apparently infiltrated, and the definite impression was that this was a malignant process. A wedge of tissue in the bladder neck posteriorly was resected, but on microscopic examination no malignant tissue was found. After operation and stilbœstrol therapy the patient's symptoms were greatly relieved, although there has subsequently been some recurrence of the ischio-rectal swelling. No secondary deposits have appeared in bone, nor has the serum acid phosphatase level been elevated. The final diagnosis remains uncertain.

Bladder Conditions.

The method includes a study of the bladder, and in many cases has no special advantages over routine cystographic examination except that micturition films reveal certain functional aspects that would not otherwise be apparent —for example, in relation to diverticular emptying and in the atonic bladder.

Illustrated in Figure VII is a film taken during attempted micturition in the case of a man, aged thirty-six years, who had had recurrent urinary retention for six years. It shows the classical features of an atonic bladder. Note the flat top of the bladder, the absence of tone, and the descent of the bladder base. A cystometrogram gave the characteristic tracing of an atonic bladder.

Complications.

There have been no cases of infection, and in only two cases were there minor degrees of extravasation. These patients suffered no pain, and no ill effects resulted. In one of these cases the examination was performed eight days after dilatation of the urethral stricture, and the extravasation occurred at the site of the stricture. Since this experience examination has been deferred for longer after dilatations.

Conclusion.

We would recommend the method as a useful one in the investigation of urological conditions.

In Sweden, where the method has been largely developed, it has come to occupy a very important place in the investigation of prostatic disorders, and together with cystoscopy is used as a routine measure in all cases. Although we are now tending to widen its scope to include more conditions of a routine nature, it is by no means used in all cases, and seems to be most useful in anterior urethral conditions, and in unusual posterior urethral and prostatic conditions. It has the advantage over cystoscopy that functional, as well as structural, aspects are revealed. Structural aspects can in some cases be better appreciated by being seen at a distance, and the magnification and short perspective of the cystoscope sometimes give false impressions of size and length, and we have found in the few routine prostatic cases examined that the estimate of prostatic size is aided by the examination.

No anæsthetic is required, and the absence of trauma to the large, soft prostate are two points in its favour as a substitute for cystoscopy in selected cases.

The value and interest of the examination are dependent very largely on the close cooperation of the radiologist and the genito-urinary surgeons in the selection of cases, the discussion of results and the follow-up examination.

THE DIAGNOSIS AND TREATMENT OF RENAL PAIN.[1]

By JAMES PETERS,
Melbourne.

THE life of a consultant urologist can be made very pleasant indeed when a patient presents with the statement that he has had renal pain, he thinks he has a stone and further supports this opinion by saying that his local doctor is of the same opinion and that an excretion pyelogram which has been prepared proves it. At other times it can be extremely unpleasant—when patients present with a story of renal pain, as they describe it, and when they have had every investigation known to man performed, and in certain cases even various types of kidney surgery, but they still have their disability.

I do not intend to define renal pain as such in this gathering. We know only too well that the diagnosis of a retroperitoneal lesion is very confusing. A pain in the loin may quite easily mean a lesion of the kidney, of the adrenal, or of the associated retroperitoneal tissues. We also know that in traumatic cases pain in the loin is a problem and one which requires a lot of clinical judgement and occasionally special tests to determine whether the lesion is simply that of the kidney or has an associated intraperitoneal lesion.

I shall try in a few minutes to demonstrate to you that apparently identical lesions can produce a very different pain—pain may be in the loin or may radiate anteriorly passing over to the epigastrium or extend down to the iliac fossa—and to show further that it often requires a large amount of special investigation to determine exactly what particular type of treatment is indicated.

Physiology.

As an introduction I should like to refer briefly to the physiology and histological anatomy of the kidney and to review the pathway of the pain fibres which come from the kidney. The kidney capsule and substance proper are in close contact with the posterior abdominal wall and it is the somatic nerve supply of this area which is involved in lesions of this portion of the kidney.

The pelvis has a layer of circular muscle fibres with two longitudinal muscle coats, the calyx has one longitudinal and one circular coat. This circular coat is thickened and more pronounced in certain areas such as the infundibulum and the pelvi-ureteric junction and gives rise to a form of sphincter. The lining of the pelvis itself is transitional squamous epithelium, and in the calyx the apex of the pyramids is covered by a tessellated cuboid form of epithelium.

The nerve supply of the kidney has now been very accurately worked out—there is a somatic supply as well as a sympathetic and parasympathetic supply.

The somatic nerve supply is, of course, associated more with the capsule and the perirenal tissues and from these the afferents travel, the nerves involved being the tenth, eleventh and twelfth thoracic and the first lumbar nerves.

The sympathetic nerve supply is relayed from the lower sixth thoracic by the splanchnic nerves, greater, lesser and least, and relays in the cœliac ganglion and passes to the aortic and renal ganglions, and from there to the kidney itself. The route of the post-ganglionic fibres is mainly in association with the blood vessels.

The parasympathetic nerve supply is from the cranial autonomic and passes in the vagus nerves, mainly the right vagus. The connector fibres here correspond to the preganglionic fibres in the sympathetic and the excitor neuron passes direct to the organ itself, and it is probable that their significance is rather small.

Comparison of Nerves.

It is important here I think to compare briefly the arrangement of the fibres in the somatic and sympathetic nervous systems.

[1] Read at a meeting of the Urological Society of Australasia on April 20 to 23, at Surfers' Paradise, Queensland.

In the spiral reflex arc there are three neurons—the afferent neuron with the cell body in the posterior route ganglion, the connector neuron which transmits the impulses to the anterior horn from the posterior horn of grey matter, and the excitor neuron which passes from the anterior horn cell to the voluntary muscle.

In the sympathetic system these neurons have a different course. The afferent neuron proceeding from an internal organ has the nutrient cell lying in the posterior route ganglion and the central process sent into the grey matter. The connector neuron is situated not in the posterior horn but in the adjacent grey matter just laterally, and the connector fibre passes not to the anterior horn but to the peripheral ganglion, so that the connector fibres must wander away from the central nervous system to the ganglion, wherever they are situated.

Of course, in the case of the kidney the course of the connector neuron is out along the mixed spinal nerve, then to the sympathetic chain and it passes down along the greater, lesser and least splanchnics to the cœliac ganglion; from there the fibres are relayed to the renal ganglion and finally the kidney; then thirdly there are the excitor cells which lie peripherally in the ganglion. These excitor cells are the so-called post-ganglion fibres and they pass out from the ganglion to the viscera.

In the case of the kidney this post-ganglionic relay may be through a variety of channels and pass not directly across from the cœliac ganglion but communicate with the renal ganglion and aortic ganglion or possibly pass across to the other side.

The pathway for pain may then be (*a*) via the somatic nerve supply in association with perirenal tissue or possibly from fibres in the so-called pedicle mesentery; or (*b*) via the autonomic system afferents arising from the distension of the hollow musculature. But in considering the finer detail of neurons it is seen that the actual course of post-ganglionic fibres is not accurately assessed and it is the pre-ganglionic fibres that are of major importance.

Referred pain then follows the afferent impulses and gives the associated muscle-guarding or rigidity noticeable particularly in inflammation or in lesions involving the outer covering of the kidney pelvis.

By experiments with injection of the first interspinous ligament symptoms are produced, practically identical with the pain of renal colic. We know that renal pain itself can be felt directly localized over the kidney or may be irradiated to the epigastrium, down towards the iliac fossa or down along the psoas, and maybe down the leg.

Clinical Cases.

With regard to clinical cases I do not want to go into any great detail with regard to common renal lesions, but you will all remember cases in which there has been what appears to be an identical pathological lesion in certain patients and yet the story of the pain is somewhat different in each case. There are certain observations I have made myself in investigating the cases of large "idiopathic" hydronephrosis which quite often occurs in younger people.

These patients may complain of pain over the renal angle and quite often have some degree of referred pain lower down in the back or even in certain cases passing down the leg. If perhaps the cause of the relay was from the perirenal tissues you would think that there would be some associated inflammation, but in many cases there is no infection and yet this peculiar distribution of pain occurs.

In other cases the patients complain of an abdominal form of pain which passes up under the rib on the right side and radiates towards the epigastrium. Strangely enough, retrograde pyelography in some of these cases is followed by a direct acute pain felt over the kidney in the abdomen when the hydronephrosis is moderately filled.

This, of course, is different from the type of pain which occurs with pyelovenous back-flow or excessive distension of the hydronephrosis. That pain is usually acute and occurs in the back as well as directly over the kidney in the side itself. Certain patients with horseshoe kidney, particularly when the condition is complicated by formation of hydronephrosis or stone, will often have pain in the abdomen directly over the kidney and there results a confusion of diagnosis with certain intraperitoneal lesions such as ulcers.

The pain of calyceal stone is very confusing. We have all met cases in which a stone has been fairly firmly held in the calyx and the patient has suffered no pain at all; whereas if the stone drops out into the pelvis or is in contact with and actually pricking the mucous membrane of the pelvis, accurate localizing pain usually directly over the kidney and renal angle will result. Inflammatory lesions on the other hand quite often give a diffuse renal angle pain which remains as a dull ache and is accompanied by the reflex signs of guarding and rigidity over the renal angle which is very noticeable clinically in comparison with the other side.

With a chronic inflammation such as tuberculosis it is surprising how the patient on being closely questioned will give a vague history of ache in the affected loin. We know that the pathology of tuberculosis is fairly definite. The lesion itself, starting in the kidney substance and then passing through into the pelvis, later gives rise to a spasmodic and anterior pain and possibly to associated clinical hæmaturia, and then by the lymphatic spread again passes back to reinfect the kidney itself and to give rise to associated pain with regard to inflammation or irritation of the capsule.

In the acute inflammation also of pyelonephritis which occurs in certain cases of blood-borne infection to the kidney with abscess formation, the so-called carbuncle of the kidney causes a very definite localizing pain which is almost certainly somatic in origin because it is so closely in contact with the perirenal tissue; the capsule itself is affected and on clinical examination these patients usually have extreme tenderness and accompanying signs of rigidity over the loin.

A variety of types of pain occur in association with similar lesions and it shows how important complete investigation is in renal conditions to determine exactly the full extent of the condition itself, as well as to make an accurate diagnosis and distinguish the condition from other retroperitoneal lesions.

This introduces the importance of special tests, particularly retrograde pyelography, because it is this which distinguishes most accurately and tends to reproduce the actual pain of the so-called "idiopathic" renal conditions in which the patients are often labelled neurotic.

The Doubtful Case.

The doubtful cases are the troublesome cases—the ones in which all forms of investigations have been carried out quite often without any degree of accuracy, and as there is no infection the kidney functions well and no method has been used to determine exactly what portion of the kidney gives the pain or whether the pain is a true renal pain. We know that one of the common causes of pain is distension in all hollow organs, and the kidney is no exception—and it is the distension of the muscle coat which quite often sets up the pain impulse.

It is quite often found that the retrograde pyelogram in these cases is performed under general anæsthesia and there is no way of determining whether the pain has been reproduced or not. I suggest in some of these cases you find by retrograde pyelography with local anæsthesia that on distension of the pelvis the disabling pain is reproduced. These are the rare forms of true "nephralgia". In many cases the patients complain of pain due to pyelovenous back flow or of some discomfort from the catheter, but they do not experience a complete reproduction of the pain which constantly troubles them.

Often it is very difficult to come to a decision, but when you can actually reproduce in an apparently normally functioning kidney the pain the patient complains of you must consider accurately the method of management.

Treatment.

In the straight-out cases of stone in the kidney or kidney tumour, of course, the treatment is obvious and I do not intend to discuss them at all. Suffice for me to say that

we are all agreed that the more conservative the surgery of these definite lesions, the better. But in the case of the so-called nephralgia, the type which I mentioned in more detail in which the pain can be reproduced in retrograde pyelography, I think that the method of management is first conservative—conservative with regard to the use of belladonna, the use of antispasmodics, the improvement of general body tone and the use of abdominal support; but if these are not sufficient, I do not think that nephropexy or renal denervation is a satisfactory procedure. I can say nothing in favour of renal denervation, because the nerve supply is far too complicated for a simple procedure like renal denervation to be performed.

I say simple because this is quite incomplete, and on inspection of the renal vessels, however accurately you look, you can never be certain you have got all the fibres.

The only method which is useful is the method of interruption of the preganglionic fibres. We know now that the investigations and the surgery of angina and surgery of pancreatic colic by sympathectomy are successful in so far as they interrupt the preganglionic fibres, and in these cases the only way to interrupt the preganglionic fibres is by division of the splanchnics.

One method is: first, removal of the twelfth rib and an approach completely behind the renal fascia. Then the fascia over the diaphragm crus is incised and the greater, lesser and least splanchnic nerves are isolated, cut and pulled down to secure the maximum amount of nerve division. The greater does not present much difficulty, and the lesser pierces the diaphragm and joins the aortic renal ganglion and is a bit harder. The least usually comes down with the sympathetic trunk and goes to the renal plexus, passing beneath the medial lumbar costal arch.

The easiest way here is to divide the sympathetic trunk and take as much as you can get at reasonably in the area. The rami have to be cut, and it is difficult to decide in some cases whether it is a nerve or a small vessel, but the silver clips are hæmostatic and diathermy is invaluable if any "strife" occurs. With this method I think the kidney is deprived of preganglionic impulse and the pathway to pain interrupted.

The question of dividing the nerve filaments around the vessels by renal denervation is difficult to decide for two reasons: first, it is a bit exhausting by the time you have finished the sympathectomy part, and, secondly, there should be no necessity theoretically to divide the filaments around the vessels.

If some penicillin is left in the area and the kidney is supported by a Deming nephropexy, the wound can be closed without drainage.

Post-operatively there is usually a complete loss of renal pain, but it does occur in these sympathectomy cases that the pain comes back about the fifth or sixth day and then goes completely. No one seems to know the reason for this.

In conclusion may I suggest that there are some cases of kidney pain with a good functioning kidney, the so-called case of "nephralgia"? To separate these cases, investigation should be complete and accurate in a conscious patient. The treatment is first conservative, and surgery if needed should be extensive enough to interrupt the pain fibres.

OBSERVATIONS ON FEMALE INFERTILITY[1]

By G. SHEDDEN ADAM, F.R.C.O.G.,

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I APPRECIATE the opportunity of taking part in this symposium. It seemed to me that a meeting of urologists would be chiefly interested in knowing something of the approach of the gynæcologist to the infertile marriage, together with some informal comments on the subject generally, with special reference to female infertility. These I shall attempt to make, though necessarily in a somewhat discursive manner.

[1]Read at a meeting of the Urological Society of Australasia on April 20 to 23, at Surfers' Paradise, Queensland.

A marriage is assessed as being possibly infertile if conception has not occurred after a period of twelve months of reasonable opportunity. In a recent survey of 400 infertile couples personally investigated, there were 238 instances of primary infertility and 162 of relative infertility. Of the former group, almost half (110 couples) had been married for more than two years but less than five years. The average age of the wife was twenty-six years and the average age of the husband was thirty-two years. The distribution of the age groups in the female partner was as follows: under twenty-five years, 44 patients; twenty-five to thirty years, 174 patients; over thirty years, 182 patients. Varying periods and methods of contraception had been practised by 119 of the 400 couples; the remaining 281 couples did not admit to any attempt to prevent conception.

The data sought at the first consultation include details of the husband's occupation and that of the wife before marriage, and whether she is still working. Personal experience has tended to confirm the general impression of lowered fertility amongst the professional classes, due at least in part, however, to the later age at which marriage occurs in this section of the community. I have observed also a lowering of male fertility, by accepted standards, to be by no means uncommon in the case of self-employed small farmers and of young husbands seeking to establish themselves in their own business or other private undertaking. Chronic fatigue and diminished libido are possibly factors operating here; the condition, however, appears to be reversible, and provided the couple are still young and otherwise healthy, a few words of advice about "the things that money can't buy" are often sufficient to bring the ambitious but overworked young husband to take stock of the situation and to apply the obvious remedy. By the same token I tend to take a firm line with young married women who complain of the infertility of their marriage and who are yet loath to give up their well-paid office job. (In many instances the couple are planning to build a home, and high costs have forced them both to work.)

It is not unusual to find that the wife works in a clerical occupation from 9 a.m. to 5 p.m., and that household chores keep her up till almost midnight on many evenings and fill her week-ends. Opportunities for conception become infrequent, and a mild anxiety state develops, aggravated by a low-grade fatigue syndrome.

I stress these potential infertility factors because they apply especially to the younger age group, in which the commencement of a family, even at the expense of financial stringency, is important to future happiness, and in which potentialities as good parents have not yet been impaired by the passage of the years. There seems to be a good case for "marriage loans" as practised by the governments of some countries.

Dyspareunia, usually of functional and occasionally of organic origin, is another impediment to conception in young married couples, and provided that this psychosomatic order is not of long duration, it is usually amenable to treatment.

We find it worth while to make an assessment of the general physical type of the female partner as the relevant case history is being recorded.

An obviously hypogonadal habitus may be noted; the long limbs, the slenderly built trunk, the small bust, may (though not necessarily) point to a relatively low level of ovarian endocrine activity.

Varying degrees of androgen-œstrogen imbalance may be suggested by excessive (though not gross) development of facial hair, by deepness of the voice and by the general demeanour. Mild degrees of subthyroidism may be suspected on the usual clinical grounds as the interview proceeds; and the pituitary-thyroid type of obesity, with the accompanying history of long periods of secondary amenorrhœa, tells its own story of profound endocrine derangement.

The medical history of the female partner of an infertile marriage does not usually yield much useful data, unless of some serious illness at or about puberty which may have adversely affected subsequent ovarian activity. The

surgical history frequently tells of an appendicectomy, and occasionally there is reason to suspect an associated localized peritonitis at the time with involvement by adhesions of the right Fallopian tube. The gynæcological history, and in the case of relative infertility, the obstetric history, are of course all-important and cannot properly be discussed here. Suffice it to make the following general observations:

1. Delay in the appearance of menstruation up to the age of fourteen or fifteen years does not in itself indicate any serious infertility factor.

2. Minor degrees of menstrual irregularity have no clinical significance. Gross irregularity may be indicative of anovulatory cycles.

3. The significance to be attached to a history of earlier pelvic inflammatory conditions will depend on whether these occurred before or subsequent to the introduction of sulphonamides and antibiotics.

4. Notwithstanding the last observation, a history of one or more criminally induced abortions will, in the majority of cases, be followed by evidence of varying degrees of tubal obstruction.

5. A history of a previous laparotomy for "chocolate cysts of the ovaries" (ovarian endometriosis) suggests a poor prognosis, even though conservative ovarian surgery was practised at the time. Tubal obstruction from extrinsic adhesions is a common finding.

The most careful pelvic examination will only occasionally reveal significant infertility factors, especially when one is dealing with primary infertility. If present, they will, of course, receive the appropriate treatment, and it may be useful to say something at this stage on our attitude to uterine retroversion in relation to apparent infertility. There is plenty of evidence to show that conception can and does often occur in spite of such uterine displacement. On the other hand, there is reason to believe that, no other infertility factors being apparently present in either partner, severe retroversion may lead to infertility under the following conditions: (a) if there is gross forward and upward displacement of the cervix in relation to the site of the seminal pool; (b) if there is a fixed retroversion which is causing genuine dyspareunia and thus infrequent coitus; (c) if there is a fixed retroversion with a history of repeated miscarriages occurring between the twelfth and fourteenth weeks.

Under only one of these circumstances do we advise surgical correction of the displaced uterus. However, to be on the safe side, patients with a mobile uterine retroversion are asked to report early in any pregnancy, and a Smith-Hodge pessary is fitted.

We are reluctant to diagnose uterine hypoplasia as an infertility factor or, in fact, as being present unless (a) there is gross aplasia of this organ, or (b) there is clinical evidence of persistence of the pubescent type of uterus, in which the *cervix uteri* and the corpus are of approximately the same length, or (c) the degree of hypoplasia, though not gross, is part of the general picture of the hypogonadal type just referred to.

Treatment with œstrogens tends to be more successful in the third type of patient; it should be given a trial in the second clinical type referrred to, but is of coursé ineffective in the face of gross aplasia.

Any patient previously known to have a hypoplastic uterus who conceives after a period of difficulty should be given prophylactically high-dosage œstrogen therapy to minimize the risk of miscarriage.

Chronic cervicitis with or without actual erosion of the cervix is not an infrequent finding in cases of "one child sterility", and the response to simple cauterization is often dramatic. However, cervicitis of long standing tends to be associated with low-grade salpingitis, and tubal obstruction may result.

Of special interest is the subject of "cervical hostility", which may be present even in the absence of cervical abnormality or obviously abnormal cervical discharge.

This phenomenon deserves special attention when other infertility factors cannot be demonstrated, and I make a practice of estimating the pH of the cervical mucus and, if necessary, carrying out the sperm-mucus invasion test of Seguy and Vimeux. There is probably a limited place in such cases for the pre-coital douche with the use of a buffered nutrient solution to create at least temporarily a more favourable environment for the sperm.

Of the special procedures designed further to investigate female infertility, Rubin's test of tubal patency still remains the most generally useful. However, it has become a valuable therapeutic as well as a diagnostic measure, and repeated tubal insufflation with carbon dioxide gas by means of the "high pressure" techniques (200 to 250 millimetres of mercury) has been shown to be followed by a higher proportion of pregnancies than the older surgical procedure of salpingostomy (Grant, 1950). It is now usual for a therapeutic insufflation to be repeated every two to three months.

A hysterosalpingogram gives much useful information in regard to the site and extent of any tubal obstruction, and the introduction under pressure of the opaque medium may be effective in establishing tubal patency when tubal insufflation with carbon dioxide has failed.

Gynæcologists engaged in sterility investigation and treatment become wary about carrying out these procedures on the Fallopian tubes when the history or physical signs suggest prior inflammatory episodes. Estimation of the white cell count and blood sedimentation rate are wise precautions in such cases if reactions are to be avoided. Antibiotics are sometimes used prophylactically beforehand. Prolonged tubal spasm may lead to false conclusions regarding tubal obstruction; but the chance of this is reduced by the administration of pethidine before Rubin's test is performed, and by the choice of one of the new less viscous opaque media for salpingography.

Because of the importance of gentle peristalsis and ciliary movement in conveying the ovum to the uterus, Fallopian tubes rendered rigid and denuded of cilia by previous inflammation may prevent conception as effectively as blocked tubes.

An apparatus has been designed for recording on a revolving drum the presence or absence of tubal peristalsis at the time of insufflation with carbon dioxide.

The technique of the premenstrual endometrial biopsy has been greatly simplified by the development of a variety of suitable biopsy curettes, and much useful information can be obtained from this source. The presence of occasional anovulatory cycles is probably within normal physiological limits, but persistent anovulation can reasonably be inferred if, in the absence of other infertility factors, a premenstrual biopsy demonstrates complete absence of the typical histological appearance of the endometrium in the late premenstrual phase. Since women suffering from anovulation often have irregular cycles, one frequently has to depend on premonitory symptoms of impending menstruation, such as mastalgia, and to be prepared to carry out a biopsy at short notice.

Treatment of non-ovulation is carried out by the administration of the follicle-stimulating pituitary gonadotropic hormone (F.S.H.), overlapped and followed by the luteinizing hormone (L.H.), all stimulative treatment being completed by the fourteenth to sixteenth day of the cycle. We have not used radiation therapy to the pituitary or to the ovaries for this condition.

A well-timed endometrial biopsy will do more than give evidence for or against ovulation. It has proved a valuable method of demonstrating a deficient luteinizing (or progesterone) effect on the premenstrual endometrium, even in the presence of ovulation. It is stated that this condition leads to imperfect nidation of the fertilized ovum, and, although logical, this statement is hard to prove or disprove. Nevertheless, it is one of the most satisfactory conditions to treat in terms of both subsequent pregnancies and improved menstrual function.

Because it appears that the life of the ovum, if not fertilized, is limited to some forty-eight hours, much thought has been given to methods of assessing, in any particular individual, the probable time of ovulation so that opportunities for conception are not missed. Accurately

recorded daily temperature charts, demonstrating as they do the "ovulatory trough" and post-ovulatory rise in temperature records, are undoubtedly valuable; but the emphasis must be on the term "accurately recorded". Should the patient, for one reason or another, find it impossible to keep accurate records, it is reasonable to assume that ovulation occurs fourteen days before the ensuing menstrual period, regardless of the length of the cycle. Thus, for women with twenty-eight day cycles, ovulation may be presumed to occur on or about the fourteenth day (from the first day of the last menstrual period). But if the patient's cycle was reasonably constant at thirty-four days, ovulation is assumed to occur on or about the twentieth day from the beginning of the previous menstrual period.

The gynæcologist should work out for each individual patient her own fertile period of the month, the calculation being based if necessary on the average length of cycles and providing for a margin of time on either side of the actual estimated date of ovulation. By estimating in this way a six-day "possible fertile period" and asking that there be three opportunities for conception during this time, this important physiological aspect of reproduction is not overlooked. This is especially important in the older age group, or when because of illness or fatigue in one or other partner, libido has diminished but the desire for parenthood remains strong.

Should an infertile woman give a history of mid-menstrual "spotting"—that is, slight vaginal bleeding midway between the menses—or of transient lower abdominal pain at this time (the so-called *Mittelschmerz*), these signs are evidence that ovulation occurs at about this time.

I do not wish to introduce statistical data in these general remarks, but I have included the following item of interest from the recent personal survey of 400 infertile marriages previously referred to. The incidence of male infertility was as follows: as the major or sole cause of the infertile marriage, 18·5%; as a contributory cause, 23·3%; total, 41·8%. Statistical studies on ætiological factors in the female tend to be misleading, because multiple "infertility factors" in the one patient are much more common than a single "major infertility factor".

There are many other aspects of this subject which cannot be dealt with here; for example, the problem of habitual abortion, leading none the less to a childless home, has received much attention of late and our results are improving. I have no "routine treatment" for these cases; each is dealt with as an individual problem. In relation to infertility generally, there is more recognition of the need to treat the whole individual, especially in terms of psychosomatic, endocrine, metabolic, dietary and occupational factors. Treatment tends to be preceded by proper investigation and is therefore rational rather than empirical. And, I need hardly add, the need for proper investigation and, if necessary, treatment of the male partner has for some time now been readily recognized, and it is on this theme that I now look forward to hearing the views of members of your society.

INFERTILITY IN LIVESTOCK.[1]

By T. K. EWEN,
Professor of Veterinary Science, University of Queensland.

BEFORE such a distinguished company of specialists in one important field of human medicine, may I be permitted to remind you of two things? The first is that the degree of control exercised over reproduction in most species of domestic animal is altogether more rigid than in humans. However, this fact acts as a double-edged sword; it enables us to increase production efficiency, but it also lands us in a great deal of trouble. Secondly, I must remind you that there is a physiological, climatic and economic framework within which we, in the veterinary profession, must approach this vexed problem of livestock sterility. Let me attempt to explain this framework a little more precisely.

[1] Read at a meeting of the Urological Society of Australasia on April 20 to 23, at Surfers' Paradise, Queensland.

PHYSIOLOGICAL CONSIDERATIONS.

Each species of domestic animal has a different œstrus cycle. It is of importance to have the time relationships of the œstrus cycle fully understood. For example, in the normal, non-parturient cow with a regular cycle of twenty-one days, we know that the egg is shed from the follicle approximately thirteen hours after the beginning of œstrus, which, indeed, marks the end of this phase. Consequently, there is the greatest chance of conception occurring if mating is arranged towards the end of the heat period.

CLIMATIC CONSIDERATIONS.

The influence of the season upon œstrus in some animals is considerable. For example, in the British breeds of sheep the shortening daylight of autumn will encourage the ewes to come into season, while with the Merino a drought will effectively prevent the onset of œstrus.

There are also pronounced variations in male fertility with the season. For example, with rams it is known that hot weather or bad nutrition will greatly interfere with the production of spermatozoa. Recent investigations by Yeates (1953) have shown that pregnant ewes kept in a hot room will conceive satisfactorily, but that they will either give birth to small lambs or produce no lamb at all. A proportion of fœtuses apparently become mummified or resorbed.

There are also important feed effects, by which I mean that inadequate and ill-balanced rations at mating periods will gravely affect the percentage fertility. It has been known for a long time how important it is to undertake "flushing"—that is, an increase in nutritional plane for females of all domestic animals just before they are mated. It is, as you will readily understand, in the Australian environment frequently very difficult to undertake. Flynn (1952) reports that in dairy herds in Victoria where spring-mating is practised, there was 12·5% infertility on the basis of conception to first mating, but this increased to 22% when winter-mating was practised.

ECONOMIC CONSIDERATIONS.

Apart from valuable stud animals or domestic pets, the degree of importance of a problem involving reproduction in livestock is directly related to the cost of treatment in terms of the animal's market value. When a farmer knows that he will have to meet the cost of transport and, possibly, expensive hormone treatment as well as a veterinarian's fee, with no certain knowledge that the treatment will prove successful, he may easily decide to send his cow to the butcher instead. That he is often wrong is seen from the fact that a New Zealand report records that, in a series of 44 allegedly sterile cows, 23 were found to be pregnant at slaughter. Asdell (1952) states that in the United States of America up to 60% of cows slaughtered on account of breeding difficulties are in calf. In other words, the veterinarian in this field of reproduction is expected by the public to attain a far higher standard of professional competence than is expected in the human cycle of the female.

Now I have to make a choice. Should I discuss the effect of the more important of these factors—of nutrition, of hormone ill-balance or of infection—upon fertility in the various animals, or should I take an animal species and consider some of the more important problems in reproduction which occur in Australia and elsewhere? I have chosen this latter method, for, after all, there are probably many among you who obtain much relaxation and, possibly, much profit from the rearing of large numbers of friendly pigs, patient cows or noble thoroughbreds. In any event, we can resort to the method of the wide survey when, later on, we consider the importance of male fertility.

FEMALE INFERTILITY.

The Cow.

I wish to discuss the bovine first, and, of course, I refer mainly to the dairy cow; but it is also true to say that the same remarks would apply to the beef cow or, indeed, to the milking goat. But I give the dairy cow pride of place because of the general belief that its product is of dietary value. Further, it is a species of domestic animal in which there has been more intensive development for production, and to which there has been devoted more research, than perhaps to any other species.

The importance of regular and properly controlled calving is seen from a recent survey made in New South Wales. The mean gestation period in cattle is approximately 280 days, although beef breeds and even strains within breeds vary slightly either above or below this figure. Let me remind you that, throughout most of her gestation, the cow is producing large quantities of milk and is, therefore, under a double strain. For this reason, good management demands that the cow be dried off for some two months before she calves, and that there be a reasonable interval before she is mated. But the aim is to have one calf per year, and the figures which I wish to present to you show that, if mating is undertaken either before or very much after sixty-three days from calving, it results in serious loss of production.

Scott (1952) conducted a survey of 228 herds in the group recording scheme in New South Wales, and found that, if the cows were divided into groups on a four-week time scale—that is, in the first group being those which were mated within twenty-eight days of calving—only 54% of the latter became pregnant. They represented 10% of the total, and in practical terms this meant that they could have a lactation period of only approximately 252 days, instead of the optimum 308 days. Furthermore, those mated between fifty-six and eighty-four days after calving—which would allow the full lactation period—had a conception rate of 78%. Of course, if mating is delayed until three months after calving, conception will be very satisfactory, but it will be impossible to maintain a twelve-months cycle.

Under such conditions of intensive and continuous production, it would indeed be surprising if the cow did not sometimes show a reluctance to breed. Indeed, surveys undertaken in many countries have shown that amongst the reasons for disposing of cows, next to culling for low production of milk, infertility is the most important reason.

As Ward (1952) in New Zealand has recently pointed out:

> Sterility in the dairy cow is a problem that has worried farmers and, consequently, exercised the minds of investigational workers in all the world's main dairying countries. It is not a new problem, but though some light has been shed on various aspects of sterility there are, so far, no clear-cut answers to such questions as what causes sterility and how can herd fertility be improved.

There are better statistics available in that Dominion than from any of the Australian States, and it appears that, in the five-year period from 1939 to 1943, the herd wastage of all cows culled for sterility or abortion was 2·6%, while in the latest two-year period of 1949–1950, it had risen to 3·5%. A subsequent analysis, embracing a large number of herds, some of whose records went back as far as twelve years, showed that there was, in fact, no increase in the sterility problem whether it is measured as the number of cows in calf to a first mating with the bull, or as the number of empty cows at the end of the breeding season. He concludes that the fact that wastage returns have shown a higher culling rate for sterility may merely be a reflection of the farmer's greater scope for culling following the widespread use of an effective vaccine against brucellosis (contagious bovine abortion) and of penicillin against mastitis. In other words, the farmer who is able to cull a fixed percentage of his herd each year is now in a position to discard animals for other reasons—such as their being "shy breeders" and barren cows—which previously were retained on the farm as late calvers or carry-over cows in order to keep the herd numbers up.

The New Zealand figure of 3·5% is low when compared with that given by Asdell (1952) for dairy cows in the United States. He states that about 10% of all cows show infertility at any one time—a figure which Hignett (1952), on the basis of wide experience in Great Britain, believes to be true for that country also.

There is certainly no support for the contention of some farmers that the control of brucellosis by Strain 19 vaccination has resulted in an increase in sterility from other causes; but there are still many causes of infertility which are not fully understood or for which we have no adequate control. May I outline the most important infections of cows known to be responsible for infertility?

Infections Causing Infertility.

Brucellosis.—In every Australian State, infection with *Brucella abortus* is likely to occur. Indeed, in this country, as in most other dairying countries, this disease represents the commonest cause of sterility from an infectious agent. Not only is the calf lost at a varying stage in the gestation period, but the resulting metritis causes delay in getting the cow into calf again. Since the late 1930's, there has been available a most effective vaccine produced from an avirulent strain (Strain 19), and there has been considerable progress in the calfhood vaccination schemes operating in most countries. The best immunological response occurs in calves vaccinated between the ages of eight and ten months, and it is generally sufficient to give one injection to protect the animal from virulent infection during its most susceptible first few pregnancies. The extent of the increase in the use of the vaccine is seen from the figures in Queensland, where, from a beginning in 1946, over 25,000 doses were used in 1951.

Vibrio Fœtus Infection.—Vibrionic abortion in dairy cows has much increased in its incidence in many important dairying countries during the last few years. Indeed, the infection was described for the first time in Australia in 1942 (Hindmarsh, 1942). As with brucellosis, the cause of the almost inevitable concurrent fall in reproduction rate is due to the resulting uterine infection delaying the onset of the normal œstral cycle. In Holland (Sjollema, Stegenga and Terpstra, 1949) it is considered to be the main cause of enzootic sterility.

Trichomoniasis.—The occurrence of the protozoan parasite *Trichomonas fœtus* is generally of a scattered nature. This is a venereal disease of the bull, and thus the importance of making a speedy diagnosis and removing the offender from the herd is obvious. In the cow, the disease is self-curing if the affected animal is given sexual rest. Artificial insemination has a particular usefulness in herds where this disease has occurred.

Endometritis.—Infections by a variety of organisms dating from parturition are by no means uncommon. Indeed, Dawson (1951), in a detailed study of 88 cases which occurred within three weeks after parturition, classified them into three groups, and found that *Corynebacterium pyogenes* infection would entirely eliminate the onset of the normal œstrus cycle. The treatment was very difficult and the prognosis generally poor. In his groups 2 and 3, in which the normal œstrus cycle had recommenced, although there was mucopurulent discharge, this was frequently sterile, and after uterine irrigation the prognosis was much better.

Vaginitis.—Vaginitis is a common cause of sterility in Australia. Although various organisms have from time to time been isolated, it has not been possible to reproduce the condition with any of them, and indeed the ætiology still remains very obscure. Many lines of treatment, ranging from a wide assortment of chemical agents through the gamut of the hormones, have been employed; but I think it is probably true to say that the results are often no better than when no treatment at all is given. Most of the affected cows will recover in time. There is seen occasionally an infectious granular vaginitis, the agent responsible apparently being a virus and associated with a preputial infection in the bull.

Endocrine Dysfunction.

Cystic Follicles.—It is generally agreed (Hancock, 1948) that the appearance of the cystic follicle is the most widely recognized evidence of ovulatory failure. The nymphomaniac cow is sometimes a problem and is generally manifesting this condition. Manual expression *per rectum* or repeated but cautious hormone therapy will occasionally prove effective. Asdell (1952) has made the point that the bovine is the most sensitive animal known to ovarian and pituitary hormones, while man is the least sensitive.

Persistent Corpora Lutea.—Persistent *corpora lutea* are a common occurrence in some herds, and result from the *corpora lutea* of pregnancy not regressing. Again, manual removal *per rectum*, with or without the administration of œstrogens, will generally trip the cow over into a normal œstrus cycle.

Nutritional Factors.

Under Australian conditions, and especially with beef cows, frank deficiency in protein, phosphorus and vitamin *A* intake can occur during drought periods. It is not surprising, therefore, that it is difficult to get cows into calf under such conditions. A series of recent studies in England by Hignett (1952, 1953) has presented evidence to show a close correlation between herds with a high incidence of sterility and an imbalance in the calcium-phosphorus ratio, so that the intake of calcium due to persistent liming in relation to the phosphorus intake is abnormally high. However, it has been pointed out by Abrams (1952) that this may well be no more than an indication of sub-optimum intake of vitamin *D* in these northern latitudes. It is not likely that an imbalance of this sort is playing an important part in sterility in Australia.

There are several large areas of trace element deficiency in Australia, particularly in copper and cobalt. The requirement of vitamin B_{12}, which incorporates cobalt, is remarkably high for the ruminant (Marston, 1952; Haeskstra, 1952). In the deficient areas there has been some difficulty in maintaining reproductive rates, but in most of these sheep, not cattle, are run.

Natural Œstrogens.

The recent finding in Great Britain that spring pasture possesses a relatively high content of natural œstrogens raises the possibility that the great ease of getting cows into calf during the spring months may be in part related to this factor.

Genetic Factors.

Finally, we come to the group of inherited defects which interfere with fertility. Most of the work which I have to report in this field has been done in the Scandinavian countries. A recently published study by Lagalof and Zettergren (1952) gives the results of a seventeen-year study designed to control hereditary ovarian hyperplasia in Swedish highland cattle. From an examination of over 8000 females from about 450 herds they found that the incidence of this hyperplastic ovarian condition was as high as 17·5% in 1936, but as a result of the campaign to eliminate it, it had fallen to just over 9% in 1948. The source of this trouble was traced to two bulls which were used a long time ago in one particular district. Other Swedish work has indicated that cystic ovaries may also be an inherited characteristic.

In all dairying countries there are the group of cattle vaguely known as "shy breeders". No doubt there are many conditions involved here, and it is probable that several of them have an inherited basis. The difficulty is to isolate them in order that a statistical basis may be revealed.

Comment.

The amount of really reliable data concerning the incidence of sterility in dairy and beef cattle in Australia is unfortunately very limited, and it is for this reason that I have had to depend so much upon the results of overseas investigation. The Australian Veterinary Association has realized this state of affairs and last year induced various State Governments to undertake surveys of sterile cows. It is hoped, within a few years, to accumulate pathological and other data which will allow us to investigate the various forms of sterility upon a much surer foundation.

The lack of attention to the problems of sterility in cattle in Australia is probably a reflection of the preoccupation of veterinary research workers with the problems of sheep, which has characterized the research field for very many years. This thought leads me to a brief consideration of the nature of reproductive failure in the ewe.

The Ewe.

I have already mentioned how the reproductive rhythm of the sheep makes it very dependent upon external environment. Indeed, the most important factor is the one of seasonal rhythm. The work of Yeates (1949) has shown that the onset of the breeding season is mainly dependent upon a light stimulus mediated probably through the anterior lobe of the pituitary, governing the release of gonadotrophins. It appears that an increasing period of darkness brings this about. The Merino breed, however, shows this rhythmic influence much less than the British breeds (Watson, 1952).

Temporary sterility in ewes is relatively common in Australia, owing, we believe, to the gross quantitative as well as qualitative nutritional deficiency of drought conditions. There are, of course, the mineral imbalance difficulties of certain restricted areas, in which copper and cobalt deficiencies play a special part. The serious form of sterility in ewes in areas of Western Australia where *T. subterranean* var. *Dwalganup* was grown (Bennetts, Underwood and Shier, 1946), due to a high œstrogen content, was fortunately only of local occurrence.

While there is the need of fine wool, there will be the need for the Merino sheep, and the Merino ewe will presumably continue to bear the brunt of our harsh and capricious climate. Its mitigation, and thus the avoidance of a large proportion of barren ewes during the drought years (and almost every year is a drought year for some part of the Commonwealth), is largely a husbandry matter. Fodder conservation methods can be much more extensively employed.

Where fat lambs are produced, particularly in the western districts of Victoria or where there is irrigation, the British breeds of sheep are employed. The need for high fertility is paramount with them, and the periodicity of œstrus is more pronounced. Mating, therefore, is almost invariably restricted to the autumn, and attempts are made to increase the nutritional plane just beforehand in order to ensure the maximum degree of ovulation.

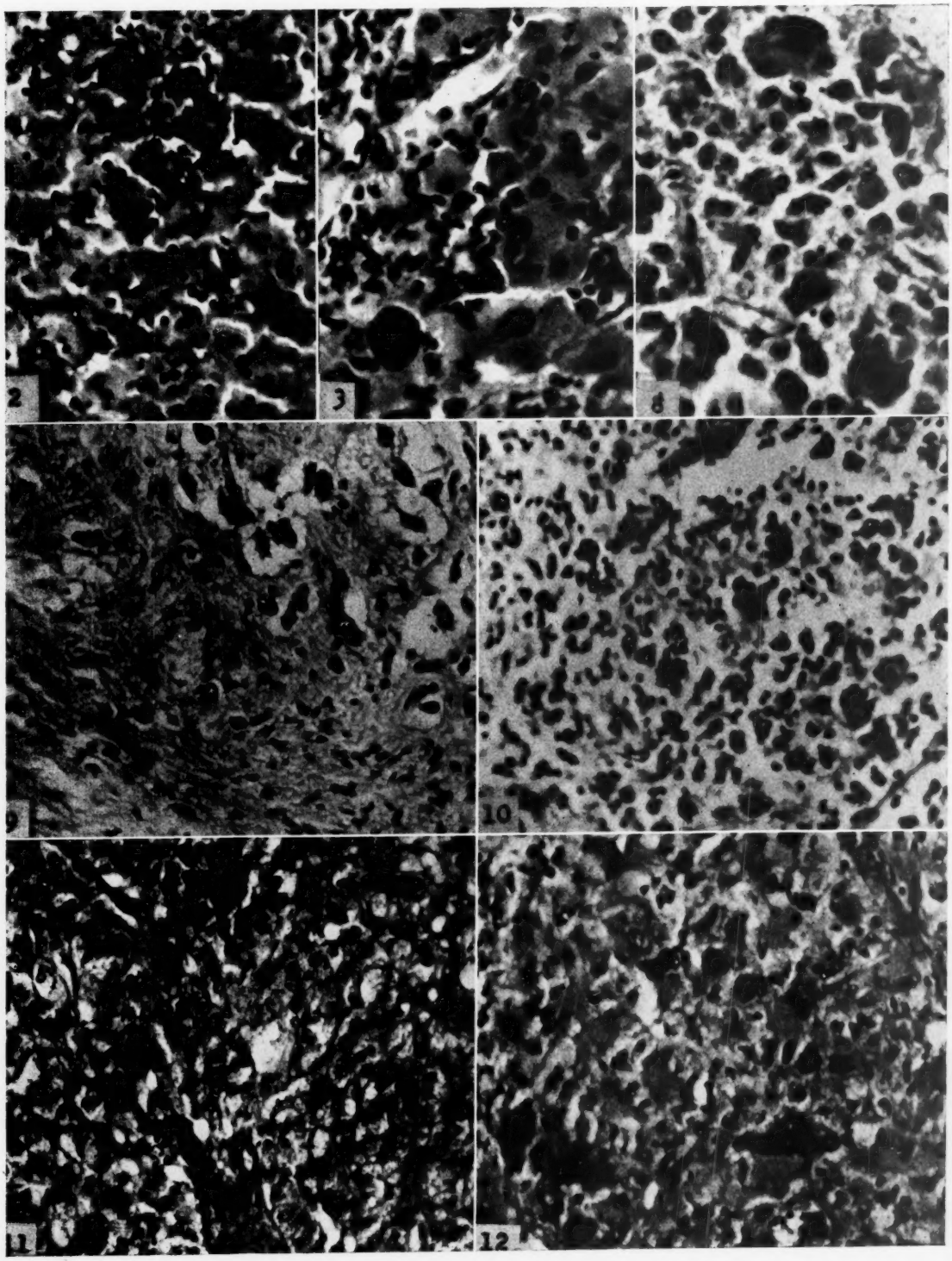
While sterility due to hormonal imbalance or specific infection is rare in the ewe, a troublesome virus causing abortion and some residual infection has appeared with increasing frequency in both Australia and New Zealand within very recent years (Salisbury, 1953). Further to reduce lambing percentages in ewes is their proneness to metabolic disorders in the last part of pregnancy. Ketosis and hypocalcæmia may be easily precipitated, especially when twins are being carried.

The Sow.

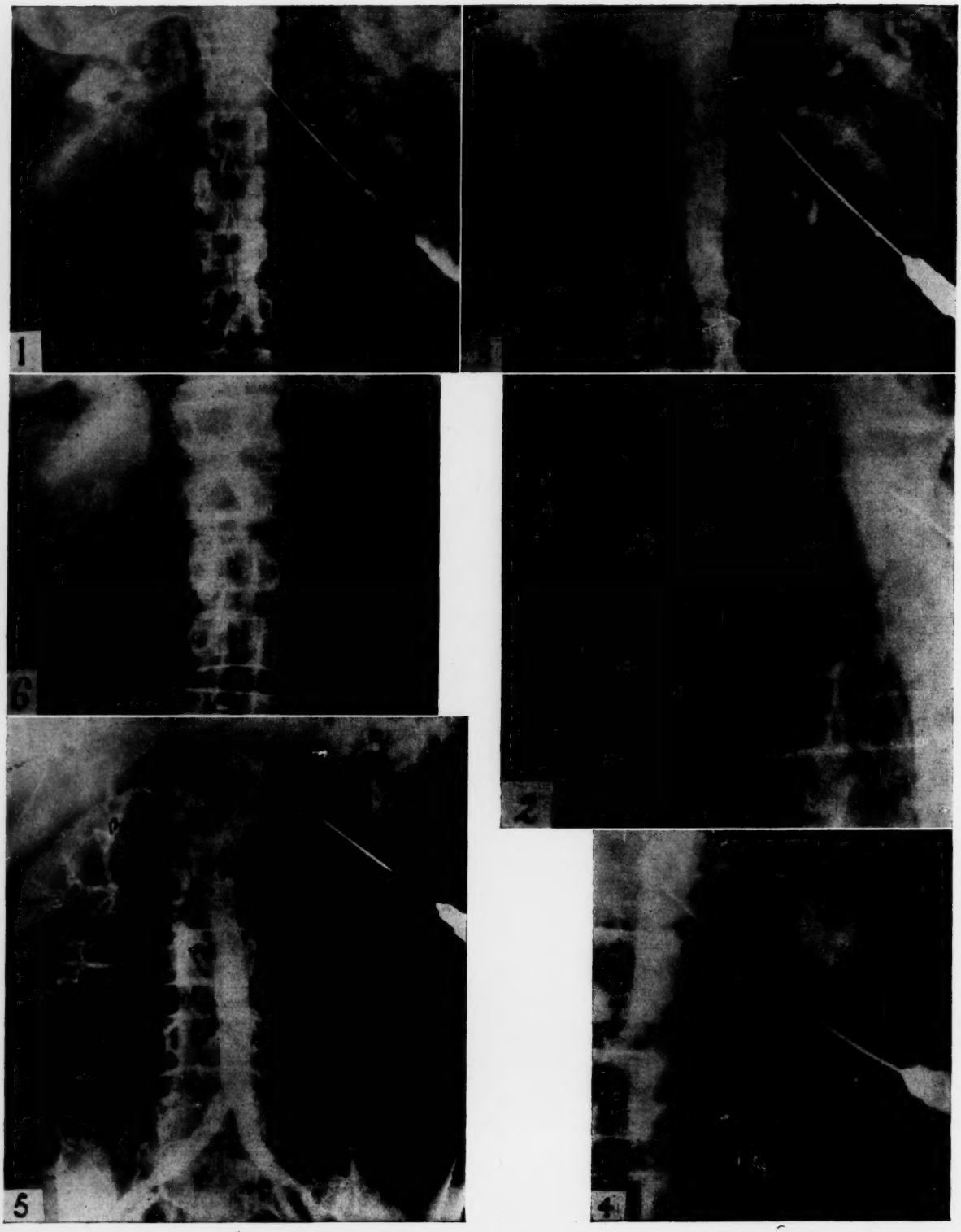
In the pig, we have both the most effective food converter, in terms of plant material into meat, and the most prolific of the domestic animals. The average litter is between seven and eight, and in well-managed piggeries it may be higher. The gestation period is less than that of any other farm livestock (120 days), which allows us to have two litters from a sow in each year if there is no trouble from infertility. Indeed, what seems remarkable is that sterility is not much more serious than it is.

Infection with *Br. abortus*, var. *suis* is unfortunately widespread in Australia; while it is a source of both direct and often serious loss, especially when it first appears in a piggery, as well as a danger to humans, it does not result in much sterility.

ILLUSTRATIONS TO THE ARTICLE BY KEITH KIRKLAND.



ILLUSTRATIONS TO THE ARTICLE BY IAN F. POTTS, M.S., F.R.C.S.



According to a recent survey by Nalbandov (1952) in America, there are two main classes of infertile sows. The first are those which are described as "hard to settle", and which are frequently disposed of after they have been mated by their owners three or more times with boars of good fertility. It is found that these sows may become pregnant if moved to new surroundings, even though the nutritional plane is not obviously changed. There are also those which make up 47% of sows culled for infertility, which do not become pregnant because of anatomical or endocrine maladies revealed only at autopsy. Half of these females are found to be sterile because of anatomical uterine defects, because the eggs could not be fertilized owing to Fallopian tubal obstructions and abnormalities such as hydrosalpinges. The other half of the group are sterile because of the failure of ovulation caused by cystic follicles. The reason for this failure of ovulation and subsequent cyst formation is unknown, although Nalbandov considers it probable that it is not due to hyperfunction of the pituitary, as some have postulated.

Unfortunately, no extensive survey of this nature has been undertaken in Australia; but it is likely that the overall figure of about 10% of the adult breeding population classified as sterile from the American survey is similar to our own problem with the sow. In the group which require an unreasonably large number of matings before conception, it is interesting to see that ovulation rates appeared normal, but that in more than half of these females the eggs obtained from the Fallopian tubes at post-mortem examination were either undivided or only in the two-cell stage. The possibility is suggested that part of the difficulty in this group may be due to delayed ovulation leading to faulty synchronization between the availability of eggs ready for fertilization and the presence of viable spermatozoa.

Finally, I must make mention of the category which is particularly troublesome in sows and is manifested by an exceptional mortality of embryos. With this trouble, litter size is frequently reduced to one or two pigs. So far, experiments indicate that there is no reduction in the number of eggs ovulated and fertilized and no reduction in the number of apparently functional *corpora lutea* present even at the end of the gestation. Indeed, it appears that death occurs soon after implantation rather than in the later stages of pregnancy. There is often no apparent reason for this impairment of fertility, for it has been shown not to be due to infection or to fautly nutrition.

The Mare.

We are all well aware of the rapid and continuous decline in the numbers of draught horses. There are, of course, in Australia a large number of station horses bred, but the conditions under which this breeding takes place are mainly uncontrolled. I think we may properly confine ourselves to consideration of the blood horse.

Great value is, for some reason, attached to many of these animals, and, as a result, some useful observations of a veterinary medical nature have been made upon them. It is necessary for us to appreciate the fact that the racing year begins in August, and that any foal born before the beginning of August is classed as a yearling. In other words, it is clearly desirable to have foals born as soon after the beginning of August as possible. We must also remember that the gestation period of the mare is very close to eleven months, so there is the need to get prompt conception in brood mares. Indeed, it is for this reason mainly that many mares are mated at the first œstrus period following parturition, spoken of as the "foal heat", which occurs between nine and eleven days after the birth of the foal. Many, however, wait until the second œstrus, which follows in about three weeks.

All workers are agreed that the commonest cause of sterility in the mare is vaginal or uterine infection, and the tendency to contract such infection increases steadily with age, owing partly to the decreasing muscle tone and slack ligaments, and partly in many mares to the virtual aspiration of infection or "wind-sucking" during exercise.

Less common causes of sterility are traumatic conditions, such as vaginal tears and even recto-vaginal fistulæ, which similarly increase with the brood mare's age.

The Kentucky workers (Dimmock *et alii*, 1949; Cronin, 1952) in England, and Millar (1952), with a small series of mares in Victoria, have all implicated a hæmolytic streptococcus as the commonest agent responsible for sterility in thoroughbred mares. *S. equirilis*, *C. pyogenes* and *E. coli* have also been implicated as the responsible pathogens in other mares. Fortunately, most of these organisms are penicillin-sensitive, and systemic treatment is reasonably effective.

Burkhardt (1947) has pointed out how improved nutrition allied to the restrained use of follicle-stimulating hormone can be successful in inducing œstrus in the maiden mare, for in a proportion of these conception is difficult to achieve.

Male Infertility.

Now it is time to turn to consider the part played by the male in the causation of sterility in domestic animals. In view of the fact that ovulation occurs at a particular time in the œstrus cycle in all domestic animals, it is easily understood how important it is to know when that is. Hammond (1926) was one of the first to make a study of these time relations. There have been many studies concerned with the most appropriate time to mate various farm animals. Some recent work by Austin (1952) shows us how important it is to have a proper period of capacitation for the sperm within the female reproductive tract before there can be penetration of the ovum. Too early or too late mating will result in missing an œstrus period.

Although infection of the male reproductive organs is not a very common cause of sterility, it must be borne in mind. The part played by *T. fœtus* in sterility in dairy cattle has already been mentioned. *Br. abortus* can be located in the testes of the bull and the boar, although it is rarer than was once thought. *Vibrio fœtus* is commonly carried in the semen. The use of antibiotics in the diluent is proving effective in reducing this hazard.

In rams, the high incidence of epididymitis and testicular hypoplasia has lately led to a search for a causative organism. Accumulating evidence in New Zealand and Queensland points to the existence of an infectious agent (McFarlane *et alii*, 1952).

On the nutritional causes of male sterility, I would like to point out that Gunn (1937) made a study of infertility in rams and showed how important was an adequate intake of vitamin *A*, while Moule (1950) has shown that the fertility of Merino rams working under conditions of excessive heat in western Queensland can be increased by the administration of thyroxine.

The increasing use of artificial insemination in animal breeding has allowed valuable studies on the relative importance of numerous environmental factors, psychic as well as physical, to be assessed. These have been fully reviewed by Parkes (1952). The part played by the male in transmitting factors which manifest themselves in partial or complete steriilty in his progeny will readily be appreciated, and reference has already been made to one of these in Swedish cattle.

Conclusion.

Sterility or reduced fertility in domestic animals is a problem of increasing importance. As technical progress presents us with new power, as we learn how to preserve semen for decades or longer, as we learn how to induce multiovulation and transfer large numbers of fertilized eggs from genetically superior females to inferior nurse cows to gestate, the need for greater understanding of all the factors which influence reproduction is intensified.

It is hard enough to become skilled at diagnosing and treating the breeding troubles of one species, but the practising veterinarian must do his best with the problems presented by several widely differing animal types. Even their normal reproductive physiology is profoundly different.

The need for increasing livestock numbers in a world where the rate of human population increase is greater than our existing power of increasing food production is an urgent one. We cannot afford to breed and keep sterile animals upon our farmlands. There is a pressing need for more research, and there is also the need for educating stockowners to make use of science's present aid. Both are challenges to us as a profession. We should like to think that we could look to our medical colleagues for understanding and support.

TUMOURS OF THE ADRENAL GLAND.[1]

By KEITH KIRKLAND,
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BEFORE discussing tumours I would draw attention to some general features of adrenal physiology. Fundamentally each adrenal consists of two glands, distinct from one another in embryology, histology and physiology.

The cortex, of mesodermal origin, elaborates hormones or sterol lipids of immense importance in the total economy of the body. They broadly regulate: (*a*) Electrolyte balance. In particular 11-desoxycorticosterone or DOCA influences sodium and chloride retention and potassium and phosphorus elimination. Capillary permeability, fluid balance and blood pressure are also affected. (*b*) Carbohydrate metabolism. This function is subserved by the so-called S group of hormones of Albright. These substances are glycogenetic in action, but in addition deaminise amino acids. In consequence abnormal secretion results in an upset of the metabolism of carbohydrate, fat and protein. (*c*) Androgenesis and anabolism. Steroids of the structure of androgens normally influence general development and more specifically development of the external genitalia and growth of hair. Over-secretion causes freakish growth and sexual precocity, mostly masculine in type. Hirsutism, particularly pubic, abdominal, axillary and facial, may be so extreme as to cause personal embarrassment.

The medulla is ectoblastic in origin, arising from the sympathogonia, primitive cells of the sympathetic nervous system destined to develop to sympathetic ganglion cells or phæochromocyte and chromaffin cells. Maturity implies totally different physiological activities, in that the latter cells secrete epinephrine or adrenaline. Hyperactivity leads to hypertensive states and hypoactivity to lassitude, weakness and hypotension.

To complicate the possibilities still further, there is an intimate but not clearly understood relationship between the adrenals, pituitary and gonads. Pathology of the adrenal thus may be primary in the glands or secondary to remote hormonal influences, resulting in clinical riddles of the greatest complexity.

CLASSIFICATION.

The following is a working classification of adrenal tumours. As cortical hyperplasia causes many similar effects and should be distinguished from neoplasms, I have included the condition for consideration.

1. Connective tissue and vascular, generally benign and asymptomatic tumours.
2. Cortical tumours—
   (*a*) Hyperplasia.
   (*b*) *Adenoma (benign).*
   (*c*) Carcinoma (malignant).
3. Medullary tumours—
   (*a*) *Ganglioneuroma (benign).*
   (*b*) Neuroblastoma (malignant).
   (*c*) Phæochromocytoma (benign or malignant).

Diagnosis.

The diagnosis of hyperplasia or tumour is often suggested when hormonal influences cause striking physical variations from normal. Overactivity of the anterior pituitary, the rare interstitial cell tumour of the testis and the granulosa cell tumour of the ovary, each cause isosexual precocity and may be confused with cortical pathological change which results in the adreno-genital syndrome. Heterosexual abnormalities also occur apart from adrenal pathological conditions. The rare ovarian neoplasm, arrhenoblastoma, can be defeminizing and later masculinizing, while in the male, Klinefelter's syndrome of hyaline degeneration of the seminiferous tubules or chorionepithelioma of the testis results in gynæcomastia. Frölich's syndrome may resemble the adreno-metabolic type.

The 17-ketosteroids in the urine represent metabolized cortical hormones and indicate the total adrenal output of androgens in the female and the combination of adrenal, two parts, and testicular, one part, in the male. They are substances with a ketone group in the 17 position of the steroid ring. Increase in the daily output is strongly suggestive of adrenal pathological change, but the belief that malignant tumours cause a greater output than innocent tumours is no longer accepted. Meredith Campbell (1951) gives the following figures as representing approximately the normal range in milligrammes for twenty-four hours.

TABLE I.

Age in Years.	Sex.	Milligrammes.
2-5	Both	0·15- 2·0
6-10	Both	1·50- 6·0
11-16	Female	2·60- 6·3
11-18	Male	2·60- 8·1
Adult	Female	5·00-15·0
Adult	Male	8·00-20·0

X-ray examination may be of great diagnostic value, particularly when combined with other studies. The flat ray in itself may show displacement of a kidney by a suprarenal mass, but pyelography, whether retrograde or excretory, is more helpful. Air studies, either following lumbar or presacral injection, may afford differential information and determine which adrenal is at fault. Aortography can prove valuable as a confirmatory diagnostic measure in the large and highly vascular neoplasms.

Connective Tissue and Vascular Tumours.

Connective tissue and vascular tumours are quite rare and are generally discovered *post mortem*. Unless the tumour is sufficiently large to cause pressure effects on other organs or marked renal displacement, diagnosis during life is unlikely.

Tumours of the Cortex.

Either of the three tumourous lesions of the cortex may or may not be actively hormonal. In the former case the type of abnormal secretions produced and the age at which these influences act, will determine the condition. In the adreno-genital syndrome in a male, premature development, both sexual and somatic, results in the "infant Hercules" type if the hormonal imbalance exists before birth. In a female, features of pseudohermaphroditism will be found when hormonal influences operate early in development before birth, while after full development, masculinization will occur. Hypertrophy of the clitoris may be entirely misleading and the vaginal orifice may be judged to be the deformity of hypospadias. With maldevelopment of the vagina this mistake can readily be made. The syndrome described by Cushing is essentially metabolic in implication, but in the range of endocrine pathology from the adreno-sexual to the adreno-metabolic, the hormonal background is seldom clearly defined and overlap of influences, masculinizing, feminizing or metabolic, occurs to produce complex and contradictory clinical pictures.

Dods (1952) has stated that in both males and females the gonads are mature in isosexual precocity when the disorder is idiopathic or the lesion diencephalic, but immature when the adrenal, ovarian or testicular pathological change is responsible.

[1] Read at a meeting of the Urological Society of Australasia on April 20 to 23, at Surfers' Paradise, Queensland.

Wilkins (1950) describes the former precocity as "complete", being due to early activation of normal pituitary gonadal mechanism as opposed to "incomplete" with failure of gonadal maturation. The 17-ketosteroid elimination is normal with "complete" precocity, but generally increased in the presence of gonadal or adrenal neoplasm. It would appear that excess androgen production results in failure of the gonadotropic hormone function.

Hyperplasia may result in enlargement of a gland to many times the size of normal. Sexual precocity with over-development of the penis and under-development of the testes may occur in the male patient. In females, over-development of the clitoris may be found with

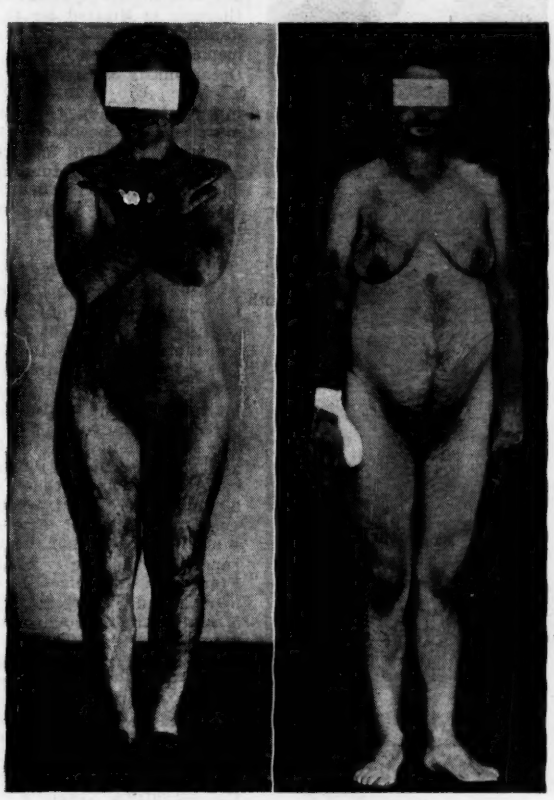

FIGURE I. FIGURE IV.

immature ovaries, and in children of both sexes abnormal growth of pubic hair occurs. Repetition of the pathological change is not unusual in siblings. Treatment for hyperplasia may be surgical, when subtotal adrenalectomy is performed, or medical, when cortisone is used to control the embarrassing genital development. Professor Dods has informed me that at the Royal Alexandra Hospital for Children the surgical approach has been unsatisfactory and control by cortisone is favoured.

Adenoma and Carcinoma.

Adenoma and carcinoma of the adrenal cortex may be considered together, as distinction between the two is often impossible, and even when the tumour is apparently completely removed, microscopic examination is not as helpful in prognosis as in growth pathology generally. Final decision often depends on the patient's survival. For convenience, I shall consider the adreno-genital syndrome and adreno-metabolic as separate entities, although it must be understood that a clear-cut separation of clinical types rarely occurs. In the former masculinizing influences are much more common than feminizing.

Last year at Saint Vincent's General Hospital I was asked to see S.F., a female, aged twenty-six years (Figure I) by Dr. Justin Markell. The patient complained of menorrhagia for the previous two years, polymenorrhœa (she menstruated twice a month for the previous year) and of a swelling in the left side which had been present for three years. She had lost one stone in weight in the preceding three months and had suffered from headache and lassitude. She had had two children, aged three and a half and two years, was well nourished and was a soft-voiced, gentle person. There was a marked overgrowth of hair on the forearms, legs and abdomen, the last-mentioned being typically male in distribution. In addition the facial growth of hair warranted regular shaving. The patient believed her general hair growth to have been abnormal since childhood, but this had become much more marked in the previous year or so. Previous illnesses were unimportant. The blood pressure was 205 millimetres of mercury, systolic, and 140 millimetres, diastolic, the fundi were normal, the clitoris was not enlarged and the 17-ketosteroid output was 8·1 milligrammes for twenty-four hours. Both kidneys functioned well, the left being displaced downwards by an easily palpable and apparently freely moveable mass. Dr. Markell advised supportive medication with DOCA, cortisone and ACTH before and after operation. On May 17, 1952, I removed a left suprarenal mass, extending the orthodox kidney incision upwards and medially. The tumour weighed 900 grammes. The patient's serum chloride content remained within normal limits during the post-operative period and it soon became apparent that the right suprarenal gland was adequate and had suffered no atrophy. Dr. Garvan described the specimen as a tumour of the suprarenal cortex and said: "There is some variation in nuclear pattern and staining and this is interpreted as indicating malignant properties." A section from the tumour (Figure II) represents a typical adenoma, but Figure III is certainly less benign. Recovery was uneventful. Dr. Markell reported the patient's blood pressure on March 9, 1953, to be 130 millimetres of mercury, systolic, and 88 millimetres, diastolic, and that she was six months pregnant and in good health. Until pregnancy supervened the menses were normal in quantity and interval. The hirsutism had not diminished.

It would appear that both androgens and œstrogens were produced in excess by the growth. As you know, their physiological antagonism never results in a balanced hormonal equation.

J.M., a female, aged forty-one years (Figures IV and V) furnished an example of the effect of carcinoma of the cortex. She came to Sydney Hospital in April, 1945. Her menses had ceased about six years earlier and about the same time abnormal hair growth appeared on her abdomen, breasts, chest, back and face. She had recently suffered from lassitude and for three months had noticed a swelling of the left side of her abdomen. Past and family history were unimportant. On April 17, 1945, the 17-ketosteroid content was 296 milligrammes per litre; that is about 450 milligrammes for twenty-four hours. An excretion urogram showed downward displacement of the left kidney. At operation on April 24, 1945, Mr. Rawle found a large vascular tumour, extending from the left diaphragm to the pelvis, originating in the left suprarenal gland and with secondaries in the liver. A biopsy specimen failed to reveal the essential structure. X-ray therapy for five weeks reduced the 17-ketosteroid content to 87 milligrammes per litre. Death occurred away from the hospital and no details are available.

Feminizing adrenal tumours are much less common than masculinizing. Mortensen and Murphy (1950) reported the occurrence of the fourteenth case in a male aged thirty-eight years. Their patient had suffered from loss of libido and gynecomastia for eighteen months prior to examination. Removal of a tumour of the right adrenal gland was followed by a return to normal of libido and breast anatomy. This is the fourth case in which the patient survived removal of such a tumour and was free of metastases at the time of the report. It is of additional interest in that the tumour was only about the size of a golf ball.

Cushing's Syndrome.

At present the term Cushing's syndrome is used to describe the clinical manifestations produced by adrenal cortical hyperfunction resulting in over-production of glycogenic corticoids. Hyperplasia is probably the commonest cause. The upset is essentially metabolic, resulting in abnormal deposit of fat, the moon-face appearance and so-called buffalo obesity. In addition to carbohydrate and fat metabolism, protein balance is deranged.

An excess of 11-oxysteroids results in deaminization of the amino acids, causing a negative nitrogen balance with muscle atony and osteoporosis. Virilization, hirsutism, hypertension and sexual precocity are variable. Under ten years of age adrenal tumour is a more common cause than hyperplasia and the syndrome is stated to be more commonly due to malignant than to innocent tumours. Whatever the background, surgery—either removal of a tumour or partial adrenalectomy—is fraught with great danger, as contralateral atrophy is very common owing to the fact that an excess of 11-oxysteroids causes cortical atrophy. This may be induced by giving cortical extract or Kendall's compound E (cortisone). Before operation the administration of ACTH may stimulate the opposite adrenal when atrophy is not far advanced. After operation cortisone and ACTH should be administered. This results in stimulation of the opposite adrenal to produce adrenal cortical hormone and also provides support when adrenal cortical response to the pituitary stimulus is adequate. Figure VI, showing a child of seven years, is typical of the physical appearance. She was at the Children's Hospital, Melbourne, and I am indebted to Dr. Powell for permission to mention the case.

FIGURE V.

E.A., a female patient of Dr. E. H. Stokes, seventy-two years of age, died at Sydney Hospital on September 12, 1952, from a rupture of a gastric ulcer. She was obese and hyperpietic (a systolic blood pressure of 160 millimetres of mercury and a diastolic pressure of 110 millimetres) and had a heavy growth of closely cropped hair in the beard area and thick hair on her forearms. She may be accepted as representing the Cushing syndrome. *Post mortem* the left suprarenal gland was found to be replaced by a tumour 8·5 centimetres in diameter (Figure VII); the drainage vein was filled with growth. The right gland was stated to be smaller than normal. Figure VIII is typical of carcinoma of the adrenal cortex.

Tumours of the Medulla.

Medullary tumours are quite distinct from those of the cortex in their clinical implications. They are three in number, ganglioneuroma and neuroblastoma, arising from the sympathetic nerve cells, and phæochromocytoma from the chromaffin cells.

Ganglioneuroma.

Ganglioneuroma is a rare tumour, innocent in nature and derived from mature sympathetic nerve cells. It may arise in any sympathetic ganglia and as a tumour of the adrenal medulla. In this latter situation it is non-hormonal and occurs as an encapsulated and benign mass. Symptoms are unusual and diagnosis is generally accidental or made *post mortem*. Histologically, groups of large unipolar or multipolar ganglion cells are found. Figure IX shows a section from a ganglioneuroma occurring in the cervical sympathetic chain.

Neuroblastoma.

Neuroblastomata are also non-hormonal tumours which occur almost invariably in childhood. They arise from immature sympathogonia in the adrenal medulla or in other sympathetic ganglion structures and are generally highly malignant. Invasion of surrounding structures is early and in the majority of cases there is no opportunity or need for a planned or detailed diagnostic approach. An upper abdominal tumour in a sick and wasting child may be first noted, but in many cases the growth momentum is such that symptoms from widespread metastases provide the first evidence. Histologically the growth consists of small round or oval cells, sometimes showing a rosette-like grouping (Figure X). The growths are radio-sensitive and cures have been said to occur even with secondaries in the liver. Wittenborg (1950) has pointed out that the scope of X-ray therapy is limited by the damage it causes to the hæmatopoietic system. Occasionally Nature effects a cure by spontaneous maturation when the immature cells become converted to benign mature cells and the tumour changes from neuroblastoma to ganglioneuroma.

FIGURE VI.

Phæochromocytoma.

Phæochromocytoma occurs more commonly in adults than in children and more frequently in the adult female than in the male. About 10% are malignant and a similar percentage multiple. They are occasionally bilateral, and Stokes (1952), in reporting such a case in a male of twenty-eight years, stated that fifteen bilateral cases had been reported up to 1947. Figure XI is typical of a benign and Figure XII of a malignant phæochromocytoma.

Hedberg recently removed a phæochromocytoma which weighed four and a half pounds, or just over two kilograms. This is larger than any I have found mentioned in the literature.

The tumour may secrete at least two active pressor substances—epinephrine and nor-epinephrine. In consequence the symptoms may vary from nil to lethal hypertension. Cahill (1952) has summarized the possibilities as follows:

1. Completely symptom free, discovery of the tumour being accidental.
2. A sudden hypertensive attack or even sudden death following minor or major trauma.
3. The adrenal sympathetic syndrome: (*a*) with a relatively normal blood pressure, with intervals of paroxysmal hypertension; (*b*) more or less continuous hypertension, with paroxysmal crises; (*c*) constant hypertension, simulating essential hypertension.

Hypertensive crisis may be characterized by headache, trembling, palpitation, pallor and general distress; sweating and vomiting with cardiac and hepatic enlargement may occur, with both systolic and diastolic pressures much raised.

Diagnosis.

As the hypertensive state and hypertensive crises both occur as features of other diseases, an attempt has been made to clarify diagnosis by the use of drugs, provocative

or antagonistic to epinephrine and nor-epinephrine. In a patient with high blood pressure and/or marked vasomotor instability, the use of provocative substances, such as histamine, 0·5 milligramme, or tetraethyl ammonium chloride, 400 milligrammes, must be accepted as dangerous and ill advised. The administration of dibenamine and benodaine, sympathicolytic and adrenolytic agents, to patients with hypertension due to an excess of circulating epinephrine often lowers the blood pressure. When this is elevated from other causes, no effect is noted. Recently, Bannon (1952) reported dibenzyline, a substance allied to dibenamine, as probably having a greater sympathicolytic and adrenolytic blocking action than the other two drugs. Intravenous and oral administration proved effective in counteracting the symptoms and signs of hyperepinephrinæmia and allowed the successful removal of a malignant phæochromocytoma. The other adrenolytic drugs failed to modify the symptoms.

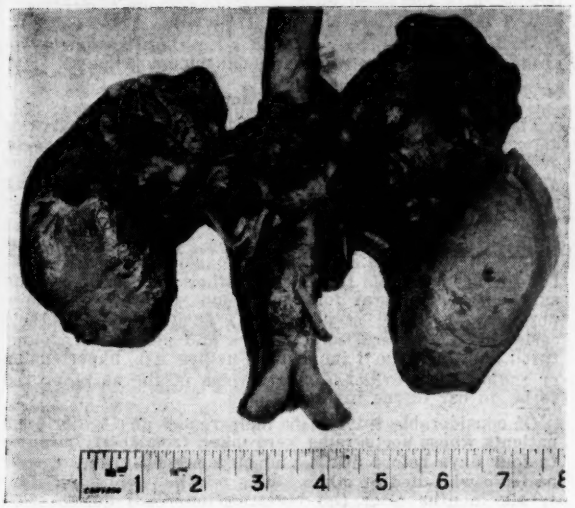

FIGURE VII.

Treatment.

Surgical removal of the neoplasm is the ideal, but this is a hazardous undertaking in a hypertensive and unstable patient. Detailed pre-operative, operative and post-operative supervision is as necessary as when dealing surgically with a highly thyrotoxic patient. In preparation, attempts must be made to reduce and to stabilize the blood pressure by judicious use of adrenolytic and/or sympathicolytic agents. At operation their use may be further indicated to meet any hypertensive crisis, while post-operatively hypotension may require supportive therapy.

ACKNOWLEDGEMENTS.

As this paper is very largely non-urological, I have had to enlist the help of my colleagues, particularly in pædiatrics and pathology, for advice and clinical material. In addition to those I have already mentioned, Professor Dods has been most generous in his help. Further, Professor F. R. Magarey and Dr. R. D. K. Reye, Dr. Alison Garven and Dr. Findlay Jones have done much to make the paper possible. Dr. E. H. Stokes and Mr. R. W. Rawle have permitted me to mention their cases. Sister Mary Regius of Saint Vincent's Hospital and Mr. Money of Sydney Hospital have made the majority of the slides. To all I am very grateful.

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TRANSLUMBAR AORTOGRAPHY.[1]

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Historical Survey.

THERE is already an extensive world literature on translumbar aortography, so its development will be reviewed only briefly.

Dos Santos, a Portuguese, was the pioneer, and he published his experiences in 1929. There were no adherents until A. Keller Doss and O. A. Nelson in the United States of America independently published their results in 1942. In the past three or four years the method has gained popularity in many countries, including the United Kingdom (Griffiths, Johnstone, Moore), Sweden (Denstad, Pamlov), and the United States (Melick, Vitt, and others). The largest single series has been produced by Smith, Evans and Elsey, who in 1952 reported a series of over 800 cases.

The earlier investigators, Dos Santos, Nelson and Doss, used a pressure apparatus to obtain the necessary speed of injection. However, this has many disadvantages, especially the danger of air embolism, and has given way to the more simple and safe procedure of hand injection. Likewise, the information obtainable from a nephrogram alone (Vesey *et alii*, 1950) is vastly inferior to that of an aortogram and nephrogram combined, and makes it a far less satisfactory procedure.

Translumbar needle puncture of the aorta is such a simple technical procedure that there is no necessity for an operative exposure of the femoral artery with retrograde passage of a catheter along the profunda artery, as described by Goodwin *et alii* in 1950. They admitted to difficulties with this method, and it unnecessarily complicates the procedure.

Melick and Vitt in 1948 were able to discover over 3000 recorded cases in the literature, and the number now is probably five times as great.

Apparatus.

The apparatus required is a 6·0 to 6·5 inch 18-gauge needle, short-bevelled, fitted with a stylet and a Luer-Lok butt: a 20-millilitre Labat syringe with finger loops; a 10-inch length of plastic tubing with fittings at either end for attachment to the syringe and needle respectively. The most satisfactory fittings are those designed by W. Scott Charlton, F.R.C.S.[2] All connexions should be very tight, as with the high pressure developed during the rapid injection, leaks or separation at the ends may occur. The Labat-to-Luer fittings and connecting tubing should be of sufficient length so that the operator's hands are well out of the exposure field (Figure IV).

Technique.

It is emphasized that the procedure is simple and easily acquired.

[1] Read at a meeting of the Urological Society of Australasia on April 20 to 23, at Surfers' Paradise, Queensland.

[2] Available from Elliott Brothers, Proprietary, Limited, Sydney.

It is very important to check the patient for sensitivity to the opaque medium. All patients are interrogated in respect to hay fever, urticaria, asthma, food allergies *et cetera*. The previous performance of an excretion pyelographic examination, without incident, is accepted as sufficient evidence of non-sensitivity. If this has not been performed, a conjunctival test is carried out, and if the result of this is in any way equivocal, a test dose of two to three millilitres is given intravenously, with antihistamines and resuscitants at hand.

It is preferable that pre-operatively the colon be emptied of its gas by a cathartic the night before and a saline laxative or enema on the morning of the investigation. Anæsthesia may be local or general. I have had no experience with the former method; it entails infiltration of the proposed needle track similar to a paravertebral block. In this series the intravenous administration of "Pentothal" has always been used. The usual premedication of morphine and atropine has been used, and commonly an intratracheal tube passed. The anæsthetist is requested to arrest respiration whilst the actual exposures are made.

The patient is placed prone on the cystoscopic or other X-ray table, with no bedding. The torso and lower limbs are supported on pillows, and one arm is extended so that the "Pentothal" may be given into a wrist or arm vein.

The patient must be accurately placed on the table so that the renal and bladder areas are over the film and, if necessary, a preliminary scout film is taken to ensure this, and also to check the technical radiological factors.

The left loin is given a surgical "scrub", and the procedure is carried out with operating theatre asepsis and drapes.

The syringe and tubing are filled with dye and placed near at hand. The needle, with stylet in place, is inserted four fingers' breadth (eight centimetres) from the midline under the lower border of the left twelfth rib. It is advanced cranially, medially and ventrally. The needle usually impinges against the transverse process of the first lumbar vertebra. It is slid over the upper border of this and advanced until it hits against the side of the vertebral body. Then with successive advancing and retreating movements, the angle being slightly altered on each occasion, the point is felt just to slide around the front edge of the vertebral body. The stylet is removed and the needle is advanced a further 1·0 to 1·5 centimetres, when it will be felt to enter the aorta. This is accompanied by a sudden "lack of resistance", similar to, but an exaggeration of, that felt during puncture of the dura in a lumbar puncture.

Bright red blood emerges at a rapid drip. The aorta should be entered at the level of the twelfth thoracic vertebra or at least above the cœliac axis, for reasons given below. If there is any doubt about the position of the needle, a new puncture should be made at a slightly different level. Cases have been reported in which the injection has gone solely into the splenic, superior mesenteric or left renal artery. This is best avoided by making a high puncture, and extravasation is avoided by seeing a rapid drip.

The tubing is connected to the needle and its position again verified by barbotage, as it is easy to advance the needle further during this connexion. The X-ray tube has previously been rotating and is warmed. The team are "alerted" and the injection is made as fast as possible. This period has averaged 2·0 to 2·5 seconds. The anæsthetist stops the patient breathing, and the "aortogram" is taken as the last 4·0 to 5·0 millilitres are being injected. The needle is withdrawn and a second casette—the "nephrogram"—is inserted and exposed as quickly as possible. This delay has averaged about four seconds.

In this series all films were 14 by 17 inches in area, the exposures were 0·05 to 0·1 second, the other factors being 77 to 90 kilovolts peak and 300 milliamperes; a flat Potter-Bucky diaphragm was used, and high-speed intensifying screens, with a 32-inch anode-film distance.

In the earlier cases "Diodrast" (70%) was used, and in the later cases "Diodone" (70%).

Melick *et alii* (1952) state that the radiodensity of the various dyes is proportional to their iodine content, and is in the following order of magnitude: 80% sodium iodide, 70% "Urokon", 75% "Neoiopax" ("Uroselectan B") and 70% "Diodrast". They recommend 70% "Urokon Sodium" as the most valuable medium, since it is of low viscosity, high radio-opacity and low toxicity. This medium has not as yet been used. There is now no justification for using the inorganic 80% sodium iodide. In dogs injection of this solution directly into the superior mesenteric artery, at laparotomy, produced gut necrosis and death (Melick *et alii*, 1952). All the organic iodide preparations are of low toxicity. Complete injection into the splenic, renal and superior mesenteric arteries has been reported without incident, as also has complete extravasation. Extraaortic injection occurred three times in this series, without sequelæ.

The physiological effect of the injection is to cause brief hypotension associated with bradycardia, followed by hypertension with increased pulse pressure and tachycardia for half a minute to five minutes (Deterling, 1952).

Aortography may be combined with simultaneous retrograde pyelography or with perirenal pneumography.

Difficulties, Dangers and Mortality.

The puncture may be difficult in the presence of a grossly deformed vertebral column, and impossible unless the aorta overlies the left border of the vertebral body. Smith *et alii* (1952), in their 800 cases, had no mortality, but were unsuccessful in puncturing the aorta in children aged under nine years. Goodwin *et alii* (1950) report success in children aged from eighteen months to eleven years, but failure in two cases. If the needle point is kept against bone it is impossible to puncture other structures, as long as the intervertebral foramen is not entered—a remote possibility. Smith *et alii* (1952) suggest that in their series hollow viscera, solid viscera and pleura were punctured and all without incident. Further, age, hypertension or radiographic evidence of atheroma of the aorta proved to be no bar to the investigation.

Of considerable interest is their report on 13 moribund patients whose aortograms were taken from thirty minutes to four days before death, and on a second group of nine patients who died of other causes within twenty-four days to six months after the investigation. All aortas were examined at autopsy. Even when the puncture had been through an atheromatous plaque there was no extraaortic bleeding, and in many cases the site could not be identified.

The work of Henline and Moore on aortic puncture in dogs is not applicable to man and is not relevant. The human aorta has a large complement of elastic tissue and the puncture tends to seal itself immediately. The rapid blood flow further prevents thrombosis.

Only three deaths have been recorded; these occurred when 80% sodium iodide was used and when the bulk of the injection entered the superior mesenteric artery. With modern organic iodide media the mortality is nil and the morbidity negligible.

On recovery from the anæsthetic the patient is asymptomatic or, at the most, complains of discomfort over the site of injection. In this series one patient, whose aorta was punctured four times owing to continued technical difficulties, had a small periaortic hæmatoma with epigastric pain for two days. In three cases of extravasation all the dye was radiologically absorbed in twelve hours and caused mild backache only for this period. The investigation can thus be confidently recommended to a patient. Excluding sensitivity reactions (which should be anticipated), the mortality will be that of intravenous "Pentothal" anæsthesia, which is almost negligible.

The procedure is contraindicated in the presence of either severe renal insufficiency or sensitivity to the contrast medium.

Interpretation.

The interpretation will be discussed only as affecting urological diagnosis; other lesions which may be demonstrated—for example, aortic aneurysms—will merely be noted.

The Normal Renal Arteriogram and Nephrogram.

The renal arteries arise from the aorta about one-quarter of an inch below the superior mesenteric artery, opposite the first lumbar vertebra or the upper border of the second. The right renal artery is often at a lower level than the left; they are of large size, and the aorta narrows appreciably distal to their origin. The arteries divide in the renal hilum into a variable number of primary branches (usually two or three). The terminal distribution in the kidney is in a "fan-shaped" manner, described by Smith *et alii*. In good quality films the small branches in the cortex are visible; but as a single exposure catches the blood flow only in one phase of a continuous event, some arteries will appear filled from origin to termination, whilst others will show various stages of incomplete filling. It is not possible to name an artery with certainty in difficult cases unless it is completely visualized from origin to termination. The branches to the intestines require to be recognized so as not to be misinterpreted.

In the aortogram some of the dye has already reached the capillaries and tubules, so that the kidney substance is of increased density and easily outlined (Figures I, III, IV and V).

When the second film is exposed about four seconds later, all the injected dye has left the arterial system, but wherever dye is pooled, concentrated or diffused it will show in the X-ray picture. The kidney thus is well outlined, owing to its complement of dye in its tubules, and on occasion the renal vein also is seen. Various other viscera also show up quite well—the spleen (splenogram, Figure I), the liver (hepatogram, Figure V), the gut (colonogram *et cetera*) and the adrenal. A. S. Johnstone has reproduced clear pictures of the splenic, superior mesenteric and portal veins.

The normal nephrogram shows a clear, uniform, diffuse opacity, of equal density on both sides, which should clearly outline the kidney. The density of the shadow is a measure of renal function, and if it is of unequal degree denotes impaired function on the less dense side, provided that the injection has been given sufficiently high so as to enter each renal artery in equal concentration (Figures I and V).

The nephrogram commonly supplies as much information as the arteriogram—for example, outlining the isthmus of a horseshoe kidney (Figure VI), revealing avascular (less dense) cystic spaces *et cetera*.

Indications for Aortography and the Appearances Obtained with the Various Lesions.

The role of aortography is becoming more clearly defined, but has not as yet reached finality. It assumes its greatest value in the following ways. (i) It gives help in the differential diagnosis of simple renal cyst from tumour. (ii) It is useful in the diagnosis of aberrant renal arteries. (iii) It is an aid in pre-operative assessment as to the possibility of conservative renal operation as opposed to nephrectomy. (iv) It provides pre-operative knowledge of the renal arterial distribution when partial nephrectomy or heminephrectomy is contemplated. (v) It has been recommended also prior to nephropexy (Palmlov). A very short pedicle or a tethering aberrant artery to the lower pole (such as from the common or external iliac artery) would contraindicate its performance. (vi) A non-functioning kidney in an excretion pyelogram, whose ureter cannot be catheterized, can only be investigated in this manner. (vii) It assists in the diagnosis of polycystic disease, congenital abnormalities, idiopathic hæmaturia, adrenal tumours, retroperitoneal tumours and cysts and splenomegaly. (viii) It is the only means of showing conclusively an aneurysm or thrombosis of the renal artery and renal infarcts (Figure III).

Otherwise, it will show the position of the placenta in suspected *placenta prævia*, and a variety of vascular diseases affecting the aorta and its major branches—thrombosis, aneurysm, atheroma, arteriosclerosis, arterio-venous fistulæ, and the Leriche syndrome (Shapiro).

Now to discuss some of the urological indications more fully.

Differential Diagnosis of Simple Renal Cyst from Tumour.

All authorities admit that the distinction of simple renal cyst from tumour is very difficult. Commonly in both conditions the patient has experienced pain and hæmaturia and has a palpable mass. The interpretation of pyelograms prompts the quotation: "*Quot homines, tot sententiæ*." Glaser (1952) said "it is impossible to distinguish with certainty between the two". Prather (1950) concluded that surgical exploration was the only reliable method.

Braasch and Emmett, from their large experience at the Mayo Clinic, make the following statement in their textbook of clinical urography: "To illustrate the futility of trying to differentiate cyst from tumour, the following illustrations of cysts simulating tumour are presented .... It is obvious that surgical exploration is the only safe procedure."

Aortograms offer considerable help. Cysts are avascular and hence have no blood supply in the arteriogram, nor do they increase in density as does the rest of the kidney in the nephrogram. Cysts communicating with the collecting system will increase in density, but in later films when a pyelogram is obtained (Figure I).

Tumours are vascular and thus have a completely different appearance. In the spaces between the tumour cells dye collects in pools, the so-called "puddling", and appears as irregular blobs throughout the tumour mass. Also the normal regular arterial pattern of a fan-shaped termination is disturbed and the arteries are irregular in size and commonly tortuous, may terminate irregularly in blobs, and show slow circulation with retention of contrast medium. The nephrogram may also show irregular retention of the dye in the vascular spaces of the tumour. This is the classical and typical appearance when a carcinoma of the kidney is present (Figure II). However, if there has been extensive necrosis or hæmorrhage into the tumour with pronounced secondary changes, one may not obtain sufficient contrast filling of the abnormal vessels for a definite diagnosis. This was first noted by Dos Santos in 1934 and has been confirmed by Doss, Melick, Vitt, Destad, Pamlov *et cetera*. This has not been seen in this series and by reports is uncommon.

If aortography is to decide the necessity for operation, satisfactory clear films are obligatory and, if need be, the investigations should be repeated. Reliance should be placed only on positive findings.

Aberrant Vessels.

With satisfactory technique aberrant vessels can always be demonstrated, and if the procedure is combined with retrograde pyelography it will show the exact relationship to the pelvi-ureteric junction. The area of kidney supplied can be seen and the effect of ligation predicted.

Aberrant arteries have been found to be very common and easily demonstrated. The diagnosis can commonly be readily made with pyelograms, but the aortogram is confirmatory and shows the number and size of the vessels, allowing a better pre-operative assessment, and whether the condition is bilateral or not (Figure IV).

Pre-operative Assessment with Regard to Conservative Operations.

Keller Doss (1946) remarked that "an organ's function is no better than its blood supply".

It is obviously futile to perform an involved plastic operation on a kidney with a permanently diminished blood supply and, contrariwise, incorrect to remove a kidney capable of recovery. If it can be shown that the blood supply is adequate, and the primary abnormality capable of correction, then it is more proper to perform a conservative operation. Hydronephrosis offers many examples for this type of pre-operative assessment. As well as the size of the renal artery, the density of the shadow in the nephrogram gives a guide to the organ's function and chance of recovery. This problem is also, of course, commonly associated with that of aberrant vessels. The size of the vessel, the number of vessels, the anticipated area of the renal infarct if the vessel is tied, and theoretical

development of hypertension are the factors to be considered. Bilateral hydronephrosis due to aberrant vessels in a young patient also points to conservatism. Similarly, if permanent diminution of blood supply is demonstrated, whatever the underlying pathology, nephrectomy is indicated for that kidney if the other side allows.

Partial Nephrectomy or Heminephrectomy.

There has recently been a renewed enthusiasm for the operations of partial nephrectomy or heminephrectomy, especially in Europe. Sembe has performed many partial nephrectomies for tuberculosis, especially if it is present in a solitary remaining kidney. Alken (1951) described renal arteriography by direct injection into the renal artery at operation, to assist in these partial removals.

A favourable division of the renal artery in the hilum may allow the artery to the area for resection to be ligated and divided there. The resulting edge of the infarct then shows the line of division, or it may show a completely unfavourable arrangement and forewarn the surgeon.

A double kidney usually has separate arteries, whose supply is unequal. If a line of demarcation is not present on the surface of the kidney this is of material assistance (Figure V).

Nephropexy.

Nephropexy is self-explanatory and, I feel, will not gain many adherents.

Non-functioning Kidney in the Excretion Pyelogram; Catheterization Impossible.

Hypoplastic kidneys, agenesis, obstruction at the lower end of the ureter with prolonged back pressure, chronic inflammatory cicatricial stenosis at the same site *et cetera* may all present as a non-functioning kidney in the excretion pyelogram, with the impossibility of catheterization. The aortogram and nephrogram show whether a kidney is present or not and the adequacy of its blood supply, if present, and give an estimate of function.

Congenital Abnormalities.

In congenital abnormalities aortography confirms a diagnosis which can usually be made with pyelography and cystoscopy. In this series a horseshoe kidney was discovered with aortography after that diagnosis had been considered and rejected on the pyelogram (Figure VI).

In ectopic kidneys the exact disposition of the organ is shown in the nephrogram, and in fused or "clump" kidneys the unity or otherwise of the blood supply is demonstrated.

Polycystic kidneys typically show paucity of arteries in the parenchyma, and these are spread widely owing to the cysts. They may be seen describing curves or gentle arcs as they surround the cyst walls. The nephrogram shows scattered, round, less dense areas of varying sizes corresponding to the cysts, and the renal shadow is large.

Adrenal tumours appear best in the nephrogram unless they are very large. The tumour is outlined, is of pronounced radiodensity and retains the contrast medium. In a gland of normal size it is not possible to identify the arterial supply positively.

With extrarenal lesions requiring exclusion, such as retroperitoneal cysts and tumours, or an enlarged spleen, the nephrogram shows whether the mass arises in the kidney or not. The arteriogram, by demonstrating the main artery of supply to the mass, assists materially in diagnosis and shows the disposition of adjacent viscera.

Hæmaturia of undetermined origin, after multiple investigations, often is thought to be due to a hæmangioma; but it cannot be proven unless the organ is removed, as it is most commonly deeply placed just outside the renal pelvis and may not be visible from the exterior. Translumbar aortography should be able to demonstrate some of these hæmangiomata if they are of sufficient size; but serial aortography would be necessary for any degree of success. Further, an early carcinoma of the kidney, not producing deformity in the pyelogram, may be revealed.

Renal Arterial Thrombosis.

Renal arterial thrombosis appears as a complete block and absence of shadow in the nephrogram (Figure III); an aneurysm appears as a fusiform or saccular enlargement of the artery. Infarcts appear as avascular wedge-shaped areas with the apex directed medially.

Discussion.

Translumbar aortography will not become a routine urological procedure, nor is it competitive to the accepted urological investigations; rather it supplements them in difficult diagnoses. It may be combined with retrograde pyelography or with perirenal air insufflation. My own impression is that it supplies more information than the latter procedure, except in adrenal abnormality. Goodwin *et alii* (1950) made the following statement:

> We do not believe that it will ever become a routine diagnostic procedure such as pyelography. However, there seems to be no good reason why it should not be used in all cases of imperfectly visualised kidneys and of renal masses of doubtful nature.

This seems a fair appraisal.

The technique as described above is simple and easily acquired, requires only readily available apparatus, carries no mortality and hardly any morbidity, and is successful if careful attention is given to the small technical minutiæ. On occasion it fails to supply the necessary information, because the exposure has been made at an unfavourable moment. This, with the foregoing technique, is purely fortuitous. The degree of filling and therefore clarity of the arteries in the arteriogram is dependent on many variables—cardiac output, tone of splanchnic vessels, pulse rate, velocity of blood flow *et cetera*.

These may be estimated pre-operatively, but unduly complicate the procedure. It appears preferable to take multiple pictures on the assumption that one of these will coincide with maximal filling and radiodensity. We have thus had made at Sydney Hospital an automatic machine which will take a maximum of 20 films at intervals of half a second. The non-metallic film holders are screened, 15 inches by 12 inches in size, and of light weight; the table incorporates a fixed grid, and the automatic timer allows preselection or a duty cycle. A. S. Johnstone (1952) has shown from films so obtained that the individual clarity of various arteries (for example, the renal and splenic arteries and the aorta) may not coincide, and although the aorta may be outlined for three or four seconds, one picture is usually much better than the rest. However, this picture may not coincide with the maximum clarity of its branches. He writes as follows:

> Serial radiographs are essential to abdominal aortography if the fullest information is to be obtained. Apart from the improved demonstration of the arterial field and the clearer definition of many viscera, some of the main veins may be outlined.

These impressions have been derived from a small personal series of 50 cases. There were no deaths. Extravasation occurred three times without incident, and a presumed periaortic hæmatoma once.

Summary.

1. The development of translumbar aortoraphy is briefly outlined from its first report in 1929.

2. The apparatus and a technique are described.

3. The various media, with their pharmacological and toxic effects, are described. The precautions, contraindications, difficulties, dangers, morbidity and mortality are discussed.

4. The simplicity of the technique is emphasized and it is suggested that it may be confidently recommended to patients with due indication.

5. The normal arteriogram and nephrogram are described.

6. The indications for translumbar aortography are discussed, together with the pictures obtained with the various renal abnormalities. The procedure is of most value in the following circumstances: (*a*) for the differential diagnosis of simple renal cysts and tumours; (*b*) for the demonstration of aberrant vessels; (*c*) for pre-operative

assessment, especially in hydronephrosis, of whether a conservative operation is indicated; (*d*) for contemplated partial nephrectomy or heminephrectomy; (*e*) prior to nephropexy; (*f*) when a non-functioning kidney appears in the excretion pyelogram, whose ureter cannot be catheterized; (*g*) in renal artery thrombosis or aneurysm and renal infarcts; (*h*) to assist in the diagnosis of polycystic disease, congenital abnormalities, retroperitoneal tumours and cysts, adrenal tumours, idiopathic hæmaturia and any abdominal mass of indeterminate origin and pathology; (*i*) in general surgery and obstetrics.

7. The place of aortography in urological investigation is indicated.

8. It is suggested that maximum information is dependent on serial aortography.

Acknowledgement.

It is a pleasure to record my indebtedness to my seniors of the urological staff at Sydney Hospital, where all these investigations were performed. Most of the punctures were carried out on their patients, and I am grateful to have had access to the varied clinical material and to their rich experience. The cooperation of the radiological department was essential and was willingly given.

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Legends to Illustrations.

FIGURE I.—The patient was an obese, middle-aged woman, with a mass attached to the lower pole of the right kidney; aortography was carried out for differentiation between simple cyst and tumour. The aortogram appears to be late, in so far as the bulk of the dye is in the lower part of the aorta and the iliac arteries, and there is already a dense nephrogram. It is seen that the lower pole, on the right side, has not increased in density as compared with the upper pole. The left nephrogram is normal. A diagnosis of simple renal cyst was made, which was confirmed at operation.

FIGURE II.—Right kidney—cancer of the upper pole. The aortogram shows well the "puddling" of dye, the irregular termination of vessels and the increased density in this area. The "puddling" had disappeared in the nephrogram.

FIGURE III.—(1) Superior mesenteric artery overlying left renal artery. (2) Jejunal branches of superior mesenteric artery crossing the middle and lower thirds of the left kidney. (3) Splenic artery. (4) Hepatic artery. The patient was a male, aged sixty-three years, with prostatic symptoms and hæmaturia. A cystoscopic examination revealed prostatic varicosities, and a right retrograde pyelogram was suggestive of tumour. The clinical problem was thus whether the hæmaturia was due only to lower tract disease. The aortogram shows a large left kidney with normal blood supply, but no right renal artery. In the nephrogram the right kidney was not visualized. Diagnosis of right atrophic kidney due to renal arterial thrombosis was made, and an unnecessary loin exploration was prevented.

FIGURE IV.—The patient was a young man with a stone in the left renal pelvis. The pyelogram showed mild pyelectasis, possibly due to aberrant vessels. The aortogram shows these aberrant vessels. The condition was verified at pyelolithotomy. An artery (marked "X") crossed the pelvi-ureteric junction. The stone is outlined.

FIGURE V.—Investigations had revealed an infected hydronephrosis of the lower half of a left double kidney. The aortogram shows a normal right renal artery (2). An artery supplies the upper half of the left kidney (10). Only the upper half of the left kidney has increased in density (retouched). A heminephrectomy was performed (Dr. K. Kirkland), with removal of an avascular chronic pyonephrosis. Other vessels visualized are the following: (1) superior mesenteric; (3) splenic; (4) hepatic; (5) jejunal and ileal branches of (1); (6) terminal arcades in small intestine; (7) inferior mesenteric; (8) ileo-colic; (9) right colic; (11) descending branch of middle colic; (12) gastro-duodenal.

FIGURE VI.—A male patient, aged fifty-nine years, had complained of recurrent left loin pain for years and recent hæmaturia. Investigations revealed left hydronephrosis and nephrolithiasis. The nephrogram with a right ureteral catheter *in situ* shows clearly a horseshoe kidney. The isthmus crosses the fourth lumbar vertebra, and is seen to be less vascular (that is, dense) than the rest of the renal substance. The irregular opaque line above the upper pole of the left kidney is due to spilling of dye on withdrawal of the needle.

ACTH AND CORTISONE IN UROLOGY.[1]

By DOUGLAS B. DUFFY,
Melbourne.

IT has been known for many years that the anterior lobe of the pituitary gland exercises a number of different functions, amongst the most important of which is the control of the endocrine glands by means of tropic hormones. That hormone controlling the function of the adrenal cortex was called the adrenocorticotropic hormone, but it was not until 1946 that sufficient purified extract of this hormone was obtained to enable its clinical uses to be tried in humans. The purified extract of ACTH is a polypeptide, and it produces its effects by stimulation of the adrenal cortex. In order to produce this effect it must have a functioning adrenal gland to work on.

The production of ACTH itself appears to be under the control of the hypothalamus in certain conditions, such as stress. Because ACTH is a polypeptide it must be administered parenterally, being destroyed in the intestinal tract if given orally.

Cortisone is a crystalline hormonal substance, isolated by Kendall in 1936 from beef adrenal glands and named by him Compound E. It is a steroid compound, and attempts were made to synthesize it from bile acids—Reichstein produced 11-desoxycorticosterone in 1943, and Sarett synthesized Compound E, or cortisone as it is now designated, in 1946. In appearance cortisone is a white powder; it may be given parenterally or orally in tablet form.

Functions of ACTH and Cortisone.

The actions of ACTH and cortisone can be elucidated to a degree by observing the normal functions of the adrenal gland which, as has already been mentioned, are controlled

[1] Read at a meeting of the Urological Society of Australasia on April 20 to 23, at Surfers' Paradise, Queensland.

by ACTH. The adrenal cortical hormones appear to exercise three basic functions: (i) electrolyte-controlling effect (salt hormone); (ii) regulation of carbohydrate, protein and fat metabolism ("S" hormone); (iii) androgenic and anabolic effects ("N" hormone).

Electrolyte-Controlling Effect.

In excess, the electrolyte-controlling effect leads to sodium and chloride retention, to increased plasma and extracellular fluid, and to increased excretion of potassium. The most powerful electrolyte-controlling steroid synthesized is 11-desoxycorticosterone, the 11 and 17 oxysteroids (Compound E and Compound F) being much less powerful in this regard.

Regulation of Carbohydrate, Protein and Fat Metabolism.

Administration in excess of this adrenal fraction will lead to an increase in blood glucose levels and glycogen stores, to an increased conversion of protein to carbohydrate, to increased mobilization and utilization of depot fat, to increased renal clearance of uric acid, to a lysis of lymphoid tissue and to a decrease in circulating eosinophile cells. The oxysteroids and Compound E are examples of this hormone. These compounds have only a fraction of the salt-retaining properties of 11-desoxycorticosterone, but if they are given in large quantities their effect in this regard is adequate. Thus satisfactory electrolyte balance in Addison's disease can be maintained by administration of cortisone if it is given in sufficient dosage.

Androgenic Effects.

These steroids are referred to as adrenal androgens or "N" hormone. Their effect is one of masculinization with retention of nitrogen, phosphorus, potassium, sodium and chloride. They account for all the androgens in the female and for about two-thirds of the androgens in the male, the other third being from the testicles. Their administration is evidenced by a rise in the 17-ketosteroids in the urine.

Mode of Action.

The mode of action of cortisone when used as substitution therapy is obvious, but the reason for its beneficial action in certain inflammatory diseases is not known. The increased level of circulating oxysteroids appears to arrest the inflammatory reaction in those diseases particularly affecting mesenchymal tissues—for example, rheumatoid arthritis.

Administration and Dosage.

ACTH can be administered only parenterally, because, as was mentioned before, it is a polypeptide and is broken down in the intestine if given orally. It is a white powder made up in 10-milligramme ampoules; it is then dissolved and administered continuously by the intravenous drip method or intermittently by intramuscular injections. The doses employed vary, but 10 to 20 milligrammes every six hours are an average dose for a non-acute condition. The continuous rather than the intermittent dosage is probably better, but it is inconvenient from a practical standpoint, particularly as it has a tendency to produce clotting in the veins, necessitating the use of heparin in the solution.

ACTH is more powerful, rapid and certain in its action than cortisone, but its disadvantages are its expense and the fact that it has to be given by injection. A long-acting ACTH, now becoming available, will be a big improvement, as it is in solution, and one injection of 20 milligrammes will last for twenty-four hours.

Cortisone may be administered orally in tablet form—25-milligramme tablets—or by intramuscular injection. The average dose is 25 milligrammes every six hours.

Complications of ACTH and Cortisone Administration.

Prolonged administration of ACTH will lead to cortical hyperplasia with the possible development of Cushing's syndrome. This can be avoided by using minimal doses. Prolonged administration of cortisone may also lead to this development. With ACTH administration the normal pituitary ACTH is depressed and the adrenal cortex stimulated, whereas with cortisone both the cortex and the pituitary gland may become atrophic. Thus sudden withdrawal of cortisone following a long course of treatment may lead to acute adrenal insufficiency. Cortisone should be withdrawn gradually and ACTH administered for two or three days in order to stimulate the adrenal into activity again.

Retention of salt and water is often only of a minor nature, but may be a danger in actual or latent cardiac failure. Daily weighing and accurate recording of fluid balance is the best indication of this complication. It may be advisable to reduce the salt intake or to administer mercurial diuretics to control it.

Tuberculosis, latent or active, is an absolute contraindication to the use of these drugs. It is wise as a routine measure to examine radiologically the lungs of patients who are to receive treatment, because inadvertent treatment of tuberculous patients may lead to a rapid spread of the disease.

Non-specific intercurrent infections may occur and spread with very few signs while patients are taking these drugs. A careful watch must be kept for this and antibiotics given concurrently if indicated.

Diabetes presents some problems, but can usually be controlled in patients receiving ACTH and cortisone.

Psychoses may become aggravated.

Hypopotassæmia, indicated by muscular weakness, electrocardiographic changes *et cetera*, may become manifest and require the administration of potassium chloride. Wound healing may be retarded or even prevented by large doses of ACTH and cortisone, but with average doses wound healing occurs normally.

Application to Urology.

So far these drugs do not appear to have a wide application to the general run of urological disorders, but they do appear to be indicated in a few specific diseases.

Osteitis Pubis.

Osteitis pubis is an uncommon disease in my experience, and when it does occur it nearly always follows some suprapubic operation on the bladder. I have seen only one case in a personal observation of over 200 cases in which retropubic prostatectomy was performed, and that case occurred before these drugs were in general use. Marshall and co-workers (1951 and 1952) reported three cases of *osteitis pubis* treated with ACTH. The relief of pain in the acute cases was dramatic, the period of treatment varying from eleven to twenty-three days, during which time one to two grammes of ACTH were given. After the cessation of treatment pain did not return in the acute cases, but in the more chronic case reported improvement was slower. Thus in this distressing disease, on which other drugs have had little effect, ACTH seems worth a trial, particularly in the early stages.

Interstitial Cystitis (Hunner's Ulcer).

Interstitial cystitis is a non-specific inflammatory condition which, as we all know, is very resistant to a wide variety of treatment.

Weaver and Tyler (1951) reported some very careful observations on four patients with interstitial cystitis before and after treatment with ACTH. The most striking result was the relief of suprapubic pain within the first seventy-two hours of treatment. Frequency and urgency of micturition decreased, bladder capacity increased, and the lesions in the bladder were reduced in size. Treatment was given for periods varying from ten to sixteen days, and in some cases the course of treatment was repeated after a relapse of symptoms. The rapid relief of pain and increase in bladder capacity with treatment suggested that a good deal of the reduction in bladder capacity is due to spasm associated with the submucosal inflammation rather

than only to fibrosis. Within four to six weeks of the cessation of treatment symptoms returned in all cases, although bladder capacity did seem to be increased to a certain degree.

ACTH may thus be a valuable aid in the alleviation of the pain of interstitial cystitis, but its use may have to be prolonged and the ultimate results are as yet uncertain.

Carcinoma of the Prostate.

The adrenal cortex is the sole source of androgens in castrated men, and while œstrogenic substances combat the androgenic effects, they still stimulate the production of androgens through the luteinizing hormone of the pituitary. So after a time the use of œstrogens and/or castration loses its effect, and patients with carcinoma of the prostate decline.

The performance of bilateral adrenalectomy has been reported, in an effort to stop all androgenic production in the body. These adrenalectomized patients can then be maintained on cortisone, which has no androgenic effects, and beneficial results are claimed with regard to their prostatic carcinomata. This is a rather drastic procedure, and Hayward (1953) reports the use of cortisone to control advanced carcinoma of the prostate in one case, the basis of treatment being that the use of cortisone causes a depression of the endogenous production of adrenal cortical hormone. ACTH could not be used in this regard, because it would cause adrenal hypertrophy and increased androgen production.

Cushing's Syndrome and the Adreno-Genital Syndrome.

Cushing's syndrome and the adreno-genital syndrome most frequently occur as distinct entities, but on occasions characteristics of both syndromes may occur in the one patient. Adrenal tumours may be classified according to their clinical manifestations of hormonal activity. Cushing's syndrome may be due either to a metabolic tumour without androgens or to a general hyperplasia of both adrenal glands. Similarly, the adreno-genital syndrome may be due to a localized tumour or to a general hyperplasia, in this case, presumably, the tissue affected being that portion elaborating the androgens in contrast to that elaborating the metabolic hormones in Cushing's syndrome.

In spite of perirenal insufflation of air and aortography, it may still be necessary for an exploratory operation to be performed on both adrenals to determine the presence or otherwise of a tumour in these cases. If a tumour is found, it is of course removed. The excision of adrenal cortical tumours associated with Cushing's syndrome has carried a very high mortality in the past, mainly owing to the fact that the contralateral adrenal is frequently atrophic from the long-continued excess of Compound E. This contralateral change is not usually present in the adreno-genital syndrome, and the removal of these tumours is relatively safe.

The pre-operative and post-operative use of cortisone and ACTH in the surgery of cortical tumours producing Cushing's syndrome has rendered this operation far less hazardous. If no tumour but only a general hyperplasia is found in a case of Cushing's syndrome, the performance of total adrenalectomy on one side and subtotal adrenalectomy on the other side is being tried with success. This necessitates subsitution therapy with cortisone. The operation is usually carried out in two stages.

The adreno-genital syndrome resulting from bilateral adrenal hyperplasia has been treated by Wilkins and his associates (1951) with cortisone in order to produce cortical atrophy. The results have been encouraging, virilization being halted and the 17-ketosteroid excretion returning to normal levels.

Hypertension.

Harrison and co-workers (1952) reported a series of total bilateral adrenalectomies in hypertensive vascular disease with the object of eliminating the salt-retaining hypertensive factors of the adrenal. The patients were then carried along with minimal doses of cortisone and desoxycorticosterone. A significant proportion of the patients showed both subjective and objective improvement. This work is still largely experimental.

Anuria.

Cortisone would appear to be contraindicated in most cases of anuria because of its salt and water retaining properties and its catabolic effect on tissue metabolism leading to increased production of metabolites. However, Moore and O'Donovan (1953) have recently reported its apparently successful use in three out of four cases of anuria due to varying causes. In one case the anuria followed cortisone withdrawal, and in the other two cases there was evidence of an acute allergic reaction which they considered responsible for the anuria. Cortisone may therefore be indicated in those cases in which an allergic inflammatory response in the kidneys is thought to be responsible for the anuria.

Other Conditions.

Cortisone is being used by surgeons in an attempt to prevent post-operative abdominal adhesions and adhesions following such operations as cup arthroplasty of the hip joint. In such cases one must remember that it may prevent wound healing or allow infection to proceed apace.

Thinking along these lines, I have wondered if cortisone would prevent or minimize the scar formation if it was used after operations on urethral or ureteric strictures.

Peyronie's disease is a condition in which I have never operated, having been taught that to do so usually made the patient a good deal worse. With the use of cortisone it may be possible to excise the offending fibrous tissue without the development of further scar in the post-operative period. I have not seen any reports on this, and I offer it simply as a suggestion.

Conclusion.

Although it is off the beaten urological track, I hope this paper has been of some interest to you, because, as you see, there are more uses for ACTH and cortisone in urology than would appear at first glance. They are not drugs which we can use every day, but they may be of great assistance to us in the treatment of certain very troublesome urological conditions.

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Reports of Cases.

UPPER RENAL TRACT HÆMATURIA.[1]

By COLIN EDWARDS,
Sydney.

PERIODICALLY it becomes necessary or is deemed advisable to remove a kidney for hæmaturia when the cause is not previously known. Such cases are usually classed as renal varix, angioma or hæmorrhagic papillitis (palindromic unilateral renal purpura—Butt), and some think they may be allergic in origin.

The two cases following do not fall into any of these classes.

Case I.

In 1938 an ex-soldier, aged thirty-eight years, was admitted to hospital with symptomless hæmaturia, from which he had suffered intermittently since 1921. He had had 19 previous hospital admissions and 11 cystoscopic examinations, but the only relevant facts in the history were that he normally lived alone on a small wheat farm which he worked, and that the hæmaturia never persisted if he remained in hospital.

His twelfth investigation was equally unfruitful, but a resident medical officer suggested subclinical scurvy as a possible cause. Methods of estimating vitamin *C* deficiency were not known to us at that time, but he was given a clinical trial on a diet deficient in vitamin *C*. Sure enough, on the fourth day a few blood cells were found in the urine, and subsequently it could be foretold with some accuracy whether or not hæmaturia would be present by a study of his diet.

Although there is no pathological or biological proof, this was considered to be due to a deficiency of either vitamin *C* or *P*, and the patient subsequently kept the hæmaturia controlled by dietetic measures.

Case II.

Case II appeared to be one of an obvious renal tumour.

Mrs. X, aged twenty-seven years, was admitted to the Rachel Forster Hospital on January 23, 1951. She complained of hæmaturia of a few hours' duration three months previously. She always had nocturnal frequency of micturition, passing urine two to four times, but in the last three months this had increased to ten to twelve times. During the day she passed urine only three or four times. She had noted a dull ache in the left loin at times, which was never severe, and in the last three months she had lost six pounds in weight. Menstruation was normally regular, but she was a fortnight overdue and subsequently was proved to be pregnant. She had had no children or miscarriages. In other respects the history was irrelevant.

Physical examination of the patient disclosed no abnormality. Her blood pressure was 146 millimetres of mercury, systolic, and 75 millimetres, diastolic. The erythrocytes numbered 3,900,000 per cubic millimetre, and the hæmoglobin value was 8·9 grammes per 100 cubic centimetres (70%). X-ray examination of her chest gave negative results. Cystoscopic examination showed no abnormality and microscopic examination of the urine disclosed red and white blood cells in the urine from the left kidney. Excretion urography produced normal pyelograms, except for a small spherical filling defect between the upper and middle calyces on the left side. Retrograde pyelography confirmed this finding, and nephrectomy was performed.

The microscopic pathology caused some discussion. The original report, *inter alia*, makes the following statement:

> Cortex and pyramidal tubules are normal. A section through the upper calyx in the vicinity of an arteriole and a vein shows a mass of fibrous tissue containing collagen fibres in the centre but being quite young and cellular at the periphery. Surrounding this mass is a rim of kidney tissue with hyaline glomeruli and infiltrated with numerous lymphocytes. Normal kidney tissue lies beyond this.
>
> The reason for this picture cannot be elucidated from the sections. It may be the result of calculus already dislodged, or may be the healing process of a small embolus or vascular thrombosis. There is no evidence of tuberculosis or malignancy.

Consulting pathologists stated that they agreed with this report.

[1] Read at a meeting of the Urological Society of Australasia on April 20 to 23, at Surfers' Paradise, Queensland.

URETERIC OBSTRUCTION.[1]

By COLIN EDWARDS,
Sydney.

Case I.

IN April, 1952, a woman, aged fifty-five years, was admitted to hospital with *prolapsus uteri*. A Fothergill repair was carried out and she went home eighteen days later, quite well.

Two months later she was again sent to hospital, with the complaint of constant nausea for six weeks and intermittent vomiting not associated in any way with meals. Examination of the patient at this time disclosed a large cystic insensitive mass in the right hypochondrium which had not been present on her previous admission to hospital. Excretion urography proved that this was a very large hydroureter and hydronephrosis; the left kidney and ureter were similarly affected, but in much less degree. Cystoscopically an abnormal mass was present, rounded, with granulomatous surface, lying in the *bas fond* and coming as far forward as the interureteric bar. The right ureter could not be seen, but a number 4F catheter entered the left ureter with difficulty. The subsequent pyelogram confirmed a degree of hydronephrosis and hydroureter on the left side.

Gynæcological opinion discounted the probability of a local lesion causing obstruction, and as a further attempt at right ureteric catheterization failed, a temporary right nephrostomy was made.

After this drainage it became possible to pass a small catheter into the right ureteric orifice, but an organic obstruction was appreciated close to the orifice. Section was then performed; a large hæmatoma was found in the uretero-vesical space containing uncoagulated blood, although it was now five months since operation. This was drained *per vaginam*, with subsequent resolution of the intravesical swelling, and to a large extent of the hydronephrosis. The nephrostomy tube was then removed.

This complication is mentioned in classical descriptions of the Manchester operation, but apparently it is rare and previously had not been known to produce ureteric obstruction.

Case II.

A woman, aged thirty-one years, complained of hæmaturia of eight days' duration. Blood was intimately mixed with the urine. During the first three days she had some pain in the region of the right kidney and ureter and pain in the urethra following micturition; she passed urine three or four times during the day and once or twice during the night. She had had pain in the right iliac fossa for one month.

In 1947 she had had a Bartholin abscess drained and subsequently the gland was removed. In 1948 she had a pregnancy complicated by *placenta prævia* with death of the *fœtus in utero*. Cæsarean section was followed by hysterectomy for hæmorrhage. (There are two adopted children.) In 1949 she underwent appendicectomy and division of adhesions. It was noted on August 1, 1952, that her blood pressure was 160 millimetres of mercury, systolic, and 110 millimetres, diastolic, whereas previously it had always been normal.

[1] Read at a meeting of the Urological Society of Australasia on April 20 to 23, at Surfers' Paradise, Queensland.

Examination of the patient gave negative findings except for tenderness in the right iliac fossa; her blood pressure was 145 millimetres of mercury, systolic, and 110 millimetres, diastolic, and her temperature was as high as 102° F. at times. Excretion urography revealed good and equal function, with dilatation of the pelvis and infundibula of the right kidney, but the right ureter was not delineated. The left pyelogram was normal. The urine at this stage contained pus and colon bacilli. Both were eliminated by brief antibiotic treatment.

A gynæcological consultant could find no pelvic lesion to account for the hæmaturia or right iliac pain. On cystoscopic examination the bladder and urethra were normal. A satisfactory blue came from the left ureter in five and a half minutes and from the right in ten minutes. A number 6F catheter was blocked at two centimetres from the right ureteric orifice, but a number 4F was subsequently passed. All specimens of urine were now sterile. In the right pyelogram a large pelvis was seen, with no filling of the ureter, but an extraureteric extravasation close to the bladder. (The radiologist made a special effort to display the ureter by injecting opaque medium during withdrawal of the catheter.) This small extravasation was readily palpable *per vaginam* and the area was quite tender. We were now satisfied that the ureteric lesion was neither tumour nor stone, as either would have been palpated equally well before the extravasation. The only other possibilities were ureteric stricture or kinking. Two cystoscopic attempts to dilate the ureter failed, and this at a site where a stricture usually responds well to dilatation.

Laparotomy was then carried out and the right ovary was found densely adherent to the posterior peritoneum immediately above and lateral to its reflection onto the bladder. When the ovary was freed, the subjacent ureter was seen to be kinked in a Z-shaped manner, and when it was stimulated some peristaltic waves failed to reach the bladder. After the ureter had been released, peristalsis continued unimpeded to the bladder.

After operation the patient was relieved of pain and hæmaturia had ceased previously. It is thought that the bleeding and more acute pain resulted from recent infection superimposed on incomplete ureteric obstruction. To date no follow-up examination has been carried out with regard to the rising blood pressure.

Reviews.

Stedman's Medical Dictionary: Of Words Used in Medicine with their Derivations and Pronunciation Including Dental, Veterinary, Chemical, Botanical, Electrical, Life Insurance and other Special Terms; Anatomical Tables of Titles in General Use, the Terms Sanctioned by the Basic Anatomical Convention; the New British Anatomical Nomenclature; Pharmaceutical Preparations Official in the U.S. and British Pharmacopœias or Contained in the National Formulary; Biographical Sketches of the Principal Figures in the History of Medicine. Edited by Norman Burke Taylor, V.D., M.D., F.R.C.S., F.R.C.S. (Edin.), F.R.C.P. (Can.), M.R.C.S. (London), in collaboration with Allen Ellsworth Taylor, D.S.O., M.A.; Eighteenth Revised Edition; 1953. *Baltimore: The Williams and Wilkins Company. Sydney: Angus and Robertson, Limited.* 10" × 7", pp. 1606, with 22 plates, three in colour, and many text figures. Price: £6 3s. 6d.

ACCORDING to the preface, several thousand words, as well as nearly 600 illustrations, have been added to this well-known medical dictionary in its eighteenth edition. The value of many of the illustrations may be seriously questioned: some fail to achieve their purpose—for example, most of the little black and white drawings intended to show various skin diseases; it is puzzling to know why. when illustrations are essentially few in number and selective, certain others have been included—for example, the pictures of apparatus for performing Marsh's test, Malgaigne's hooks and Ludwig's stromuhr; others again, even if they were much better drawn, would convey no more than the text description—for example, sketches of macroglossia and ptosis. As for the words, one must agree with the editors' strictures on ill-formed words recently coined and sympathize with their tremendous task in keeping pace with the swift advance of medical terminology. It might be a good thing if words were graded according to their effectiveness, euphony and lack of pomposity; the competition for the blue ribbon would be much less fierce than that for the booby prize, with anfractuosity, gelsemiumism, mogigraphia, subgrundation and trachelocyllosis well down the list. However, editors of medical dictionaries have little choice in what they include if their work is to be comprehensive. An interesting feature of this dictionary is a long introductory essay on medical etymology by the classical editor; in view of his remark that "a Greek word seems almost to have a personality which it loses when transliterated", it is a pity that transliteration is the rule in the body of the dictionary. It should be noted that trade names, with a few exceptions, have been deliberately excluded. The binding and general set-up of this volume are pleasing, and no doubt it will continue in its accepted place as one of the standard reference books of medical terms.

Differential Diagnosis of Common Diseases of the Eye-ground. *By Paul Tower, M.D.; 1953. New York: Grune and Stratton.* 10" × 7", pp. 254, with 129 illustrations. Price: $10.00.

"DIFFERENTIAL Diagnosis of Common Diseases of the Eye-ground", by Paul Tower, is a curious book. While it contains more than a hint of the author's personal wisdom and experience, the text appears to be written for one holding an ophthalmoscope for the first time. Yet there is, in small print, after each section, a "literature discussion" of esoteric nature but by no means exhaustive in range. The result is a falling between two stools; as the beginner can hardly appreciate the discussion, and the expert will not want to read the text proper. These things are tacitly admitted in the preface.

The author sets out to demonstrate the conditions he describes with 129 fundus photographs. Unfortunately, although the idea is a good one and would work well by projection, in reproduction they almost all fail to give a clear idea, or, often, any idea at all, of what they are intended to illustrate.

On the credit side, the book is up-to-date, accurate, and has an excellent bibliographic system. The impression remains that this writer has a very good book in him.

Dermatology: In General Practice. By Jacob Hyams Swartz, M.D., with a foreword by C. Guy Lane, M.D.; 1953. Baltimore: The Williams and Wilkins Company. *Sydney: Angus and Robertson, Limited.* 9" × 6½", pp. 602, with 253 illustrations. Price: £5 18s. 3d.

THIS is a new text-book by the Assistant Professor of Dermatology at Harvard Medical School and Post Graduate School. It was therefore read in anticipation of the high standard expected from Harvard. In the main we were not disappointed.

It is essentially a practical treatise as the title indicates, and will have a greater appeal to the general practitioner than to experienced dermatologists.

There is practically no reference to X-ray and radium technique. One dosage only is mentioned, and that is in the rather obsolete term of "2 ED" as one form of treatment of plantar warts. Surely a 1953 edition could have expressed X-ray dosage in international *r* units rather than in "erythema doses".

The author has an optimistic view as to the elusive cause of psoriasis. He considers that bacterial allergy may be the clue, and incriminates the *Streptococcus fœcalis*. If this could be the case, what a wonderful discovery it would be! But here again, this aspect has been considered and rejected by others years ago.

Excellent advice is given with reference to the use of cortisone and ACTH. The author warns us that in non-fatal skin diseases, in which these drugs are effective only when administered, and in which relapse occurs as soon as they are stopped, such therapy may produce serious complications. They should be tried only when everything else fails.

A section with popular appeal is the one dealing with the care of the normal skin. This is full of common sense, and such matter is not available in the usual text-book.

The hall-mark of the book is the chapter on "Mycotic Infections". The author devotes 78 pages to this aspect of dermatology, and it is evident that he is a master of the subject. Full information is given about cultural details of fungi, and although perhaps they are of little or no interest to the busy doctor, those interested in mycology will find the chapter a mine of information, profusely illustrated.

XUM

For a reference book so fully devoted to therapeutic information, there are a few notable omissions, such as the use of mepacrine in *lupus erythematosus*, and of aureomycin ointment in *sycosis vulgaris*.

This publication is easy to read and understand and is beautifully produced, as one would expect for the high price. It can be recommended to general practitioners who do not possess a modern text-book, and to those dermatologists who have no recent work on mycology.

Office Orthopedics. By Lewis Cozen, M.D., F.A.C.S.; Second Edition; 1953. Philadelphia: Lea and Febiger. Sydney: Angus and Robertson, Limited. 9½" × 6½", pp. 304, with 191 illustrations. Price: 60s. 3d.

THE purpose of this book is to give to general practitioners, industrial surgeons and resident medical officers more detailed information than is usually found in an orthopædic text-book on those minor but nevertheless important aspects of orthopædic practice upon which they require fuller instruction. In this aim the author is to be congratulated upon the clear and straightforward manner in which he has accomplished his task. If any criticism was to be offered, it would be that whilst not strongly supporting some particular method, he at times describes a treatment which in practice has been found to be of little value. This can be misleading to persons of limited orthopædic experience, such as the groups for whom the book is intended. In future editions it might be better to exclude some of these treatments instead of keeping them revived "for old times' sake".

Methods of diagnosing and handling the common traumatic injuries of the extremities are described and illustrated in such detail as to make their management easily understood. A chapter on club foot is followed by an account of the differential diagnosis and discussion of "a limp in a child", and this mode of presentation is followed for a crooked back, flat feet, bow legs and knock knees, clumsiness of the hand of a child, wry neck, painful arm or leg in a child, cause of an abnormal arm or leg, and finally there is a chapter on inability of a child to sit up. Then follows a similar handling of painful arm or leg in an adult, deformity of an arm or leg, weakness of the arm or leg, coldness or pain in an extremity, complaint of a painful jaw and myositis.

A very helpful chapter on slings, bandaging, plaster application, and calipers, braces, walking irons *et cetera* and their correct and incorrect application completes the formal chapters. The book concludes with a few useful hints on radiology and a chapter on how to investigate orthopædic cases for the law courts.

It is certain that all persons to whom this book is dedicated will find it a true ally in their everyday practice, and the useful bibliography appended to each chapter will prove a handy reference to wider reading. In brief, it is a most useful little book ably filling a hiatus in orthopædic literature.

Progress in Venereology. By R. R. Wilcox, M.D.; 1953. London: William Heinemann (Medical Books), Limited. 8½" × 6", pp. 206, with 36 illustrations. Price: 21s.

THIS book is a summary of progress in venereology since World War II. It is not intended to be regarded as a text-book, but "is intended as a book for the venereologist and a work of reference for those who write on venereal diseases". From this aspect it is a useful publication. Few would cover the wide range of reading that has been necessary for the preparation of this book.

The chapters dealing with each venereal disease, and with the control of venereal diseases, are divided into short sections. At the end of each section is a list of references from which the section was created. The references total over 1700. Brief comment binds together the information from the several authors listed, and creates a readable book that gives an excellent survey of modern procedure and trend of thought.

There are fourteen pages of well-produced photographs. Two of these show the appalling damage that may result from neglected yaws and bejel affecting the face.

A chapter is allotted to non-gonococcal urethritis, which has a world-wide incidence and already presents a problem in regard to both treatment and control.

In the final chapter the control of venereal disease is considered by case finding, contact tracing and prophylaxis.

We can recommend this book to those who are still interested in venereology, for they will find in it much of interest gathered together by one well qualified to judge what is of value and what is not.

Books Received.

[The mention of a book in this column does not imply that no review will appear in a subsequent issue.]

"Pictorial Introduction to Neurological Surgery", by G. F. Rowbotham and D. P. Hammersley; 1953. Edinburgh and London: E. and S. Livingstone, Limited. 10" × 7½", pp. 116, with 81 illustrations. Price: 21s.

Based on surgery carried out in the neurosurgical operating theatre at the General Hospital, Newcastle-upon-Tyne.

"Surgical Pathology", by Lauren V. Ackerman, M.D.; 1953. St. Louis: The C. V. Mosby Company. Melbourne: W. Ramsay (Surgical), Limited. 10" × 7", pp. 836, with 913 illustrations. Price: £7 12s. 3d.

For the medical student and the doctor who is concerned with surgical pathology.

"The Year Book of Medicine (1953-1954 Year Book Series)", edited by Paul B. Beeson, M.D., Carl Muschenheim, M.D., William B. Castle, M.D., Tinsley R. Harrison, M.D., George B. Eusterman, M.D., and Robert H. Williams, M.D.; 1953. Chicago: The Year Book Publishers, Incorporated. 8" × 5½", pp. 736, with 127 illustrations. Price: $6.00.

One of the Practical Medicine Series of Year Books.

"Manual of Medical Emergencies", by Stuart C. Cullen, M.D., and E. G. Gross, M.D.; Second Edition; 1953. Chicago: The Year Book Publishers, Incorporated. 7" × 5", pp. 278, with 34 illustrations. Price: $4.50.

Concerned primarily with outlining the steps to be taken early in the diagnosis and therapy of emergency medical problems.

"Handbook of Differential Diagnosis", by Harold Thomas Hyman, M.D.; 1953. Philadelphia: J. B. Lippincott Company. Sydney: Angus and Robertson, Limited. 8" × 5½", pp. 746. Price: 72s. 9d.

Prepared "for office and bedside use" by practising physicians, specialists retaining a broad interest in clinical medicine and undergraduates.

"Studies in Fluid Balance: A Guide to Intravenous Therapy", by Peter S. Hetzel, M.D., B.S. (Adelaide); 1952. Published privately. 8½" × 6", pp. 184, with 26 text figures. Price: 15s. (Available from the Institute of Medical and Veterinary Science, Adelaide.)

Based on experience gained by the author while working at the Royal Adelaide Hospital as Surgical Research Officer of the Institute of Medical and Veterinary Science.

"A Handbook on Diseases of Children: Including Dietetics and the Common Fevers", by Bruce Williamson, M.D. (Edinburgh), F.R.C.P. (London); Seventh Edition; 1953. Edinburgh and London: E. and S. Livingstone, Limited. 7½" × 5", pp. 478, with 102 illustrations, a few in colour. Price: 21s.

Thoroughly revised since the previous edition in 1951.

"Handbook of Marriage", by Evelyn Home; 1953. London: Victor Gollancz, Limited. 7½" × 5", pp. 72. Price: 2s. 3d.

Written primarily from the woman's point of view.

"A Text-Book of Bacteriology", by R. W. Fairbrother, M.D., D.Sc. (Man.), F.R.C.P. (London); Seventh Edition; 1953. London: William Heinemann (Medical Books), Limited. 8½" × 6", pp. 500, with eight plates and 14 text figures. Price: 20s.

An outline of the medical aspects of bacteriology, prepared primarily for the medical student.

"World Directory of Medical Schools", World Health Organization; 1953. Geneva: World Health Organization. In English and French. 9¾" × 6¾", pp. 220. Price: 25s.

More than 500 medical teaching institutions are listed.

The Medical Journal of Australia

SATURDAY, JANUARY 30, 1954.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: surname of author, initials of author, year, full title of article, name of journal without abbreviation, volume, number of first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

THE ROYAL VISIT.

ON February 3, 1954, Her Majesty Queen Elizabeth II will arrive in Australia, the first reigning monarch to visit this country. She comes as the head of the British Commonwealth of Nations, but she also comes as Queen of Australia, a title of which Australians are justly proud. Although Her Majesty has not been long in her exalted position, she has endeared herself to her subjects by her devotion to duty, her humanity and her happy family life. The monarchy has never stood higher in the opinion of the British peoples. George VI, of happy memory, set it on the pinnacle of public esteem, and Elizabeth II, with her radiant youth and personal qualities, has shed lustre on everything connected with her high office. But in bidding the Queen of Australia welcome to this part of her kingdom, the medical profession, in common with every section of the community, should think, as Her Majesty would no doubt have us think, of the significance of her sovereignty in her dominions and of the role of us, her subjects. In her Christmas broadcast of 1952 she bade us all, with a belief in the old traditions and in the "courageous spirit of adventure", to set out to build a truer knowledge of ourselves and of our fellow men and to work for tolerance and understanding among the nations. We were to do these things, she told us, with courage, with generosity, and with humility. Her Majesty, by her long and arduous journey, is cementing the bonds of kinship of the different parts of the British Commonwealth. Let us all then, in our plaudits of welcome, not forget that we have to seek for means to display courage, generosity and humility in the task which Her Majesty has set us to undertake.

LIFE IN OTHER WORLDS.

FROM time to time astronomers, acting spontaneously or in reply to some stock query, tell us about the conditions on the surface of other members of the solar system and give their opinion that the factors favouring life are not present. Asked concerning other systems than our own they perhaps inform us that if planets are evolved on the Laplace hypothesis (which, by the way, has a remarkable ability to revive after it has apparently been completely disproved), then there is a high likelihood that many replicas of our earth may be found; but if planets are caused by the approach of a star with sufficient gravitational pull to deform its neighbour, then the probabilities are heavily against anything resembling our solar system being evolved elsewhere. In all such speculations the error is made of supposing that the only life possible is that with which we are familiar and which has by merciless natural selection operating through untold millions of years become attuned to the physical conditions imposed by our earth. As we have no solution to the mystery of life, such an attitude cannot be defended. The problems which human ingenuity has devised human ingenuity can solve, wrote Edgar Poe; but life presents us with a problem not devised by human ingenuity, and the solution is as far away today as in the time of Aristotle. If living things were two-dimensional, existing in a "Flatland" in fact, the only conception of a three-dimensional world would be the sequence of two-dimensional pictures which an impinging three-dimensional system would produce. In the same way it is possible that all we can hope to learn about the nature of life is the sequence of physical happenings when the uncomprehended realm of the living encounters the centimetre-gramme-second world which our science investigates and describes. Writers have waxed eloquent about the "fitness of the environment" in terms which lead one to suppose that they regard each physical detail of our surroundings as necessary for life. This is true for life as we know it, but this consideration does not preclude other forms of living matter being exquisitely adjusted to totally different physical and chemical horizons. The earth's mass and diameter determine the force of gravity on the surface, and this prescribes the tensile strength of plant stem and animal bone and also the arterial blood pressure necessary to make the supply of blood to any organ independent of posture. If the tensile strength of human bone were less than is the case, then every parachute descent would produce a casualty and every fall of a child would bring about a fracture. A striking example of life adjusting itself to the environment is seen in the presence of oxygen in the air. All the oxygen in our atmosphere is produced by photosynthesis of green plants and is derived, as isotope-tagged experiments have clearly shown, from the oxygen in water. Now photosynthesis is a complicated chain reaction and must have taken many millions of years to be established. Botanists are fairly certain that the earlier forms of life, and that means plant life, obtained their structural components and also their energy from organic matter formed by non-living processes, such as the action of ultra-violet light on a mixture of water, ammonia and carbon dioxide. Eventually, when solar energy was put into service by photosynthesis, the way was made smooth for the evolution of the animal. At present oxygen exists in our atmosphere at a partial pressure of 159 millimetres of mercury; the animal body is adjusted to this oxygen tension; a greater would drive oxygen into central regions of living cells, where it would cause damage. Hence the cat, despite the proverbial nine lives, will die if it breathes air with 60% of oxygen instead

of the normal 21%; whilst the dangers of breathing pure oxygen are known to every physician. Fortunately for humanity and most vertebrate animals, a fall of oxygen tension from 159 millimetres to 121 millimetres of mercury is without any serious effect, thanks to the equilibration of hæmoglobin in solution to the oxygen tension with which it is brought in contact. This allows human civilization to build cities at the altitude of Johannesburg and Mexico City. Insects have no hæmoglobin, and so one of the delights of Alpine travel, we are informed, is immunity from the attacks of insect pests. But we are not permitted to assert that life could not exist at much higher oxygen pressures, or indeed if oxygen was completely absent as in the early stages of plant metabolism mentioned. Further, living things in other systems may have evolved methods of turning solar energy into chemical far more economical and much simpler than the complicated procedure exercised by the green plant.

Water has been described as the most anomalous of all fluids. In surface tension and electrical conductivity it is surpassed by mercury; but its solvent powers are unique, as also is its faculty of promoting ionic dissociation of electrolytes, and these play a big part in the activities of the living cell. The remarkably high figure for latent heat of evaporation gives an endothermic defence against dangerous rise of temperature in the air. Living tissue is mostly water, and the environment of living cells in all animals and most plants is aqueous. But should the spectroscope inform us that liquid ammonia constitutes the seas, lakes and rivers of another planet, that would not permit us to deny the possibility of life existing there; not life as we have it, but a life adjusted to the special conditions prevailing. The water basis of our life has necessitated that the range of temperature in our environment should be relatively narrow, and we have all experienced how profoundly we are influenced by an upward shift in temperature over a small interval despite the vigorous loss of internal heat through the evaporation of water from the skin; but again we have no right to reject as impossible the contention that the phenomena of life are present at temperatures science has only recently achieved. Who knows but in that awful cauldron of the sun, where, as old Bunsen loved to remark, "when a squall comes it rains molten iron", some form of life's mysterious ways may not be present but quite unknown and incomprehensible to us?

Even if in another world there were the exact counterparts of our gravitational force, available light energy, the same physics and chemistry of the air, the same components of the soil, the same distribution of water and the same alternation of night and day, evolution could easily have taken totally different routes. H. G. Wells wisely described his Martians as possessing tentacles and not our two pairs of limbs. Contractile tissue might operate through mechanisms which allowed change of gear, muscles might be able to push as well as pull, the engineering advantages of the wheel might be put to service, there might be organs of electrostatic perception and so forth. The sum total of physical and chemical conditions on our planet, combined with fortuity in evolution, has produced a certain type of life; but we cannot arrogate to ourselves the claim of possessing the only form possible.

Current Comment.

THE HISTORY OF GENETICS.

THE science of genetics is admittedly a product of the twentieth century although founded on the researches of Mendel, which were given to the world in 1865. One of the mysteries in the history of science, however, is the complete lack of recognition and appreciation which awaited this truly pioneer publication. Three botanists, Hugo de Vries in Belgium, Carl Correns in Germany and Erich von Tschermak-Seysseneg in Austria, were instrumental in drawing attention in 1900 to the importance of Mendel's discoveries, and Bateson, becoming acquainted with Mendel's labours through these three botanists, introduced Mendelism to the English-speaking world in the same year, 1900, and gave us the word genetics. A condensed history of genetics, including pre-Mendelian contributions to the physiology of reproduction and heredity, has been written by Dr. Claudius Francis Mayer and published in honour of the Institutum Gregorio Mendel and the International Symposium on Medical Genetics held in Rome last September.[1] Dr. Mayer modestly calls his article "a brief historical synopsis", but actually it is more than this and can be accepted as a scholarly exposition of the subject, presented with admirable perspective and illustrated copiously with portraits of the great contributors to the science. Though genetics is so very young, it nevertheless stands on a broad basis of reproductive theory, laboriously and slowly acquired. In antiquity many problems of heredity were recognized and given consideration, such as the determination of the sex of the offspring, the contribution of the male and of the female to the embryo, maternal impressions, spontaneous generation, what qualities and diseases can be transmitted and what not, atavism and the like. The attempt to discover the causes and to formulate laws was conjectural, sometimes shrewd, but more often fanciful. The Middle Ages and Renaissance contributed astrology, which was not helpful.

Perhaps one criticism of Dr. Mayer's' discussion of pre-Mendelian research may be permitted, namely, that he hardly does justice to the protracted and successful efforts of prehistoric humanity in the breeding and improvement of plant foodstuffs. All our vegetable foods today, with the exception of the sugar beet, the blue berry and some nuts, are the outcome of long and laborious selection. The cereals have been so modified through thousands of years of cultivation that the botanist has difficulty in determining their origin; the banana has been bred until it has lost the faculty of seeding (a triumph greater than any of Burbank's); the date palm requires human hands for pollination. In the animal world the "breeder's eye" has given us the sheep for wool, the cow and goat for milk, the horse for transport and power, and the domestic fowl for abundant egg-laying. Civilized man has added nothing to these.

The greatest discovery in pre-Mendelian reproductive physiology was, perhaps, the chance observation of a medical student, Ludwig Hamm, which led to Leeuwenhoek startling the world with the first description of spermatozoa (1677). In 1827 the ovum was described, and in 1839 the cell theory was established. The eighteen-seventies saw the discovery of fusion of nuclei in fertilization, and a few years later came the recognition of the existence and importance of chromosomes. One of the "ifs" of history is what might have happened had Darwin read Mendel's papers. Hirschfeld and others were convinced that Darwin would have reacted at once, but he never read them. Once Mendelism was established, the amount of research in genetics increased rapidly in volume, until today it is a far-flung branch of science needing exceptional application to keep reasonably up to date. About the future one can safely predict that heredopathology will be subjected to ever-increasing investigation, as human health and nutrition and farm economics are involved; in the field of pure

[1] *Acta genet. Med. et Gemellol.*, September, 1953.

science we have the origin and reproduction of genes, the dynamics of hereditary factors and the exact relation of phenotype to genotype, the existence of hereditary factors in the extranuclear cytoplasm and so forth.

In one country there has been retrogression and not progress, and that is Russia. Mendelism has been denounced as capitalistic, and genetic investigators (like the brilliant Vavalov) who refused to have their doctrines enforced upon them simply disappeared. As Dr. Mayer puts it, "when the facts do not fit the idea they are denied". This Russian biology "rejects the cellular theory and puts us back into the seventeenth century". There are indications that Russian politicians are beginning to discover that the world of science is laughing at them; the claim to produce nuclear substance from non-nuclear living matter has not been substantiated on this side of the iron curtain, whilst Lysenko's assertion that he has produced rye and barley from wheat has evoked nothing but amusement. This history of genetics can be warmly commended. Nothing with the same scope has been published, and the very condensation makes it welcome. The many portraits of great investigators give a human touch which is most attractive.

ACUTE SUBDURAL HÆMATOMA.

ONE of the best reasons for studying the signs and symptoms of acute subdural hæmatoma is that the outlook should be good if it is recognized in a person whose vascular system is still intact. E. S. Clark and William Gooddy[1] have published full notes on two cases which illustrate some of the problems of diagnosis. The two patients concerned had at least one point in common—palsy of the third cranial nerve on the same side as the lesion. The first patient presented difficulty in diagnosis since he gave no history of trauma. This feature, combined with a somewhat stealthy approach of the characteristic signs of local pressure, is known to be misleading, but in the present instance the history was otherwise peculiar. A man, aged fifty-three years, had been in hospital for further investigation of some suspected abnormality of the eye grounds, but no lesion of the central nervous system was disclosed, except calcification of the choroid plexuses. While awaiting his discharge from hospital the patient performed a little dance of pleasure and fell on the floor, striking his head, though without causing any immediate symptoms. Unfortunately this item of the history was unknown until after his death. Severe headache soon was felt, followed by unsteady gait and drowsiness, and he was readmitted to hospital in semi-coma. The right third cranial nerve was paralysed, with ptosis and a fixed dilated pupil; except for slight ptosis on the left side there was no other abnormality of the nervous system on clinical examination. On the second day great improvement was noted, but the cerebro-spinal fluid was evenly blood-stained and contained red cells. The diagnosis was now that rupture of an aneurysm of an intracranial vessel had taken place. The patient's condition remained satisfactory for seven days and then began to deteriorate, though no blood was now found in the cerebro-spinal fluid. He died suddenly, and at autopsy there was no sign of an aneurysm or lesion or pathological process of the intracranial vessels, but a large subdural hæmatoma was present extending over the whole of the right hemisphere; this had caused considerable pressure.

Clark and Gooddy's second case was that of a healthy man of twenty-five years of age, who merely flung himself back forcibly on the pillows as he got into bed. Severe headache was felt, and he became restless and irrational, and on the following day there were signs of palsy of the right third cranial nerve. It will be seen that the evidence of trauma was slight with this patient, as with the first. Full neurological examination led to a tentative diagnosis of a leaking intracranial aneurysm, and he was kept at rest without a lumbar puncture being performed. As in the first case, improvement was maintained at first, but recrudescence of symptoms occurred. There were signs pointing to compression, and a right carotid angiogram was prepared. This showed no sign of aneurysm, but pointed to a subdural collection of blood on the right side, a diagnosis which was confirmed by drilling burr holes in each frontal region. After blood was evacuated from the right side great improvement was manifest, and the patient made a good recovery, though further clinical examination suggested the existence of a lesion in the brain stem or the right side of the cerebellum. Clark and Gooddy give another brief case history of a patient who died from the rupture of a saccular aneurysm on the circle of Willis. Here too the single positive sign of ipsilateral third nerve palsy was observed.

These cases are well worth bearing in mind. Once student days are past, the average medical practitioner regards the nervous system as a realm of the obscure; but, although acute subdural hæmatoma is probably not very often met with, the possible connexion it provides between slight falls and injuries and the presence of a very obvious lesion of a cranial nerve is worth bearing in mind.

[1] *Brain*, Vol. 76, Part II.

A NEW ANTIEMETIC DRUG.

A TREMENDOUS amount of attention has been paid to the understanding of pain and to the development of means of controlling it, especially by drugs. It is surprising then, as Dale G. Friend and James F. Cummins have pointed out,[1] how little has been learned about the mechanism and control of nausea and vomiting until comparatively recent times, since nausea and vomiting constitute a symptom complex as distressing and almost as common as pain. In this regard, they report encouraging results in the use of a new drug, a chlorinated phenothiazine, referred to as compound 2601-A. This drug was originally developed in France, where it was shown to have several unique properties, among them the ability to block the emetic effect of apomorphine in animals. This immediately suggested that it might be a highly useful antiemetic drug for man; and after thorough studies in animals and a limited number of patients had shown it to be without observable toxic effects, studies were initiated at the Peter Bent Brigham Hospital, Boston, to determine its effectiveness against a variety of agents and conditions that cause nausea and vomiting in patients. It was first used cautiously in patients in the terminal stage of carcinoma and uræmia, each condition being complicated by serious nausea and vomiting. Usually, an initial dose given intramuscularly arrested the vomiting, and remaining doses could be given orally. To date, 70 patients have been studied with gratifying results. The drug was found to control nausea and vomiting associated with carcinomatosis, labyrinthitis, lymphomatosis, uræmia and vomiting of pregnancy, as well as that caused by aureomycin, folic acid antagonist, codeine, meperidine, methadone, morphine, nitrogen mustard, protoveratrine, terramycin, urethane and "Antabuse" given to patients under the influence of alcohol. Nausea and vomiting ceased usually within one hour after injection or oral administration of the drug. Often patients who had been unable to take anything by mouth for days were able to eat their next meal. Side-effects noted in this series were few. Dryness of the mouth and a mild sedative effect were observed in a few cases, and in three cases transient faintness, flushing of the face and palpitation developed. Careful clinical and laboratory studies, including electrocardiography, hæmatological surveys and urine examination, have shown no indication of untoward effects. The series reported by Friend and Cummins was apparently not in any way controlled, and it is to be hoped that other investigators will take the matter up and see if these results can be duplicated with controls. If they can, a notable advance will have been made in symptomatic treatment in a field where symptomatic treatment is what matters.

[1] *J.A.M.A.*, October 3, 1953.

XUM

Abstracts from Medical Literature.

RADIOLOGY.

Lateral Atlanto-Axial Displacement in Spinal Injuries.

GEORGE JACOBSON AND DENIS C. ALDER (*Radiology*, September, 1953) state that the various types of lateral offset of the articular masses of the atlanto-axial joint occur with significantly greater frequency in association with fractures and dislocations of the atlas and axis than either in fractures and dislocations of the lower cervical part of the spine or in those cases in which there are none of the conventional signs of fracture and dislocation. Since unilateral medial and bilateral offset can be produced by the normal movement of the atlas in relation to the axis, they are not necessarily the result of injury. It is suspected that some of the instances of unilateral medial and bilateral offset represent rotatory dislocations. However, bilateral spread can be produced only by fracture of the atlas, and it is highly probable that unilateral offset is due to the same mechanism. When an offset, regardless of type, is demonstrated on an antero-posterior skiagram of the cervical part of the spine, meticulous X-ray examinations of the atlas and axis may be necessary to disclose an obscure fracture of these two vertebræ.

Significance of a Solitary Mass in the Lung.

C. ALLEN GOOD, R. T. HOOD, JUNIOR, AND J. R. MCDONALD (*Am. J. Roentgenol.*, October, 1953) discuss the problem of the solitary circumscribed mass in the lung. The authors conclude that the only sign of benignancy which can be relied on with reasonable assurance is the demonstration by radiological methods of the presence of calcium in the mass. Certainly no reliance can be placed on any other radiological feature. In addition, there is no laboratory procedure or other special examination which will show definitely that a lesion is benign. Some procedure, such as bronchoscopic biopsy and cytological examination of the sputum, will indicate that a lesion is malignant. This, however, adds to the necessity for immediate operation. It does not change the course of events which should be proposed as soon as the presence of the mass is demonstrated. The efforts of the radiologist should be directed toward demonstrating, if possible, the presence of calcification within the mass. Body section radiography is valuable in this regard. Failure to show calcium does not mean that a lesion is malignant, but its demonstration seems to be the only feature which is sufficiently accurate to allow operation to be postponed indefinitely.

Pulmonary Interstitial Emphysema.

G. HERRNHEISER AND J. P. WHITEHEAD (*Brit. J. Radiol.*, October, 1953) state that pulmonary interstitial emphysema occurs more often than is generally realized. It can be found after severe contusion of the chest cage in the absence of rib fractures, and it is frequently associated with pulmonary hæmorrhage. Radiological evidence of pulmonary interstitial emphysema may be given not only indirectly by the presence of mediastinal emphysema or of pneumothorax, but also directly by radiological signs in the lung. The radiological signs in the lung may be observed either within an opacity caused by pulmonary hæmorrhage or outside it. They are easier to perceive when the air is enclosed in sizeable spaces. The following appearances have been observed: (*a*) translucencies surrounded by a very thin wall, similar to emphysematous bullæ, (*b*) translucencies surrounded by a slightly thicker marginal zone, suggestive of "air-filled pseudo-cysts", (*c*) translucencies with a characteristic sinuous outline as if formed by a number of small vesicles.

Thoracic Renal Ectopia.

H. STEPHEN WEENS AND M. HARLAN JOHNSTON (*Am. J. Roentgenol.*, November, 1953) state that a broad-based thoracic mass adjacent to the postero-medial portion of the diaphragm should arouse suspicion of high renal ectopia. With proper urographic studies it should not be difficult to differentiate a thoracic kidney from pulmonary tumours, pleural tumours and fluid collections, mediastinal masses, diaphragmatic tumours and herniæ of other abdominal viscera. On routine excretion and retrograde pyelographic examinations, the X-ray beam is directed towards the fourth lumbar vertebra. In this manner, the relation of the diaphragm and kidney becomes distorted, the high anterior segment of the diaphragm being projected above the upper pole of the ectopic kidney. Close attention should therefore be paid to the position of the kidney with reference to the spine, ribs and posterior costo-phrenic sulcus. In pyelograms in these cases it is advocated to centre the X-ray beam to the level of the diaphragm in both the antero-posterior and lateral projections, in order to obtain an undistorted view of the relationship of kidney and diaphragm. Radiologically, in addition to the anomalous position of the kidney, the abnormal ureteral length, the anterior renal hilus and the abnormal shape of the kidney should be noted.

Peptic Ulcer, Gastric Carcinoma and Arteriosclerosis.

ARTHUR ELKELES (*Am. J. Roentgenol.*, November, 1953) states that there is a very frequent association of gastric ulcer with arteriosclerosis and an extremely rare occurrence of calcified atheroma in the abdominal aorta in patients with gastric carcinoma. From a comparison of the percentage figures of calcifications in a gastric ulcer series (75%) with those of a duodenal ulcer series (34·2%) and a control series (32%), it is evident that the frequent association of gastric ulcer with arteriosclerosis cannot be attributed to mere coincidence. Calcification of arteries may be asymptomatic and does not necessarily lead to arterial obstruction, but it is often the cause of slowing down the arterial flow. Thus the conditions are set for a disturbance of balance between blood supply and demand, as it occurs in intermittent claudication and in angina of effort. In analogy to these conditions a disturbance of balance between blood supply and demand may occur in the stomach, resulting in damage to the mucous membrane and subsequent ulceration. Viewed radiologically, gastric ulcers in the aged are often large, and giant ulcers are almost exclusively found in elderly individuals. Furthermore, with advancing years the ulcers are usually placed farther away from the pylorus than those met with in the younger age groups. The duodenal ulcer series shows only a slightly higher percentage of calcification of the abdominal aorta than the control cases. This finding may be explained by the observation that many of the duodenal ulcers met with in the older age groups are of long duration, usually dating back to periods of life in which arteriosclerosis is unlikely to have played a part in their pathogenesis. However, some duodenal ulcers have their onset in later life, and in these a causative relationship to arteriosclerosis also seems likely. Viewed radiologically this type of duodenal ulcer is often large and may lack the spasticity of the duodenal cap so frequently seen in duodenal ulcers of the younger age groups. The striking discrepancy between benign gastric ulcer and carcinoma of the stomach in their relationship to advanced arteriosclerosis provides a valuable radiological sign for the often difficult differential diagnosis of ulcerative lesions of the stomach. No radiological sign can be considered as infallible, but the author's investigations suggest that calcification of the abdominal aorta, which is clearly demonstrable on skiagrams, is evidence in favour of benign gastric ulceration, whereas absence of calcification in doubtful cases should raise suspicion of malignant change.

Bone Changes in the Skull in Dystrophia Myotonica.

J. E. CAUGHEY (*J. Bone & Joint Surg.*, August, 1952) reports 14 cases of *dystrophia myotonica* and gives the post-mortem findings in another case. All subjects had radiological or other evidence of abnormalities of the skull. The most constant were a thickened calvarium, *hyperostosis interna*, small to very small pituitary fossa and extensive sinuses. It is believed that the high incidence of these changes cannot be coincidental, and it is held that they should be accepted as some of the variable features of *dystrophia myotonica*.

PHYSICAL THERAPY.

A New Method of Treatment for Arthritis.

N. S. FINZI (*Brit. J. Radiol.*, September, 1953) states that in March, 1937, he treated a patient with severe arthritis of the hands, of twenty years' duration. Severe pain in the neck had recently been present, and this was treated by irradiation. A large field, covering the cervico-dorsal part of the spine, was used; the dose given was 120*r*. A week later the pain in the neck had gone, and the pain and swelling in the hands was much better, although these had received no irradiation. Following this, a series of patients with arthritis of the limbs was treated by irradiation of the cervico-dorsal or lumbar part of the spine. The method used was to give 75*r* to the skin weekly, the dose being later reduced to about 50*r*. In all, 12 to 16 treatments are given,

so that the total dose rarely exceeds 900r. The author states that in nearly every case there has been great improvement in signs and symptoms, and that relief may last for two, three or four years. The method is quite empirical, but it is suggested that the effect may be due to an action on the sympathetic nerves or ganglia.

Treatment of Polycythæmia Vera with P^{32}.

J. D. ABBATT (*J. Fac. Radiol.*, October, 1953) reports on experiences in the treatment of 25 patients suffering from *polycythæmia vera*, who have been treated with radioactive phosphorus at Hammersmith Hospital, London. Seventeen of these patients had a previous history of hæmorrhage or had severe peripheral vascular disease, so that they would have been considered unsuitable for treatment with hæmolytic drugs such as phenylhydrazine. The author states that the actual treatment technique is simple and consists essentially of an initial single intravenous injection of P^{32} followed if necessary by a further injection or injections after assessment of the response, which is usually possible three to four months after the initial injection. Before treatment, marrow examination, peripheral blood counts, chest X-ray examination and, where possible, blood-volume estimation are made. The patient then receives an intravenous injection of five to seven millicuries of the isotope without previous venesection, unless this is demanded by the severity of the symptoms. The patient is then followed at weekly intervals initially; blood counts and, in particular, accurate platelet counts are obtained. While in the majority of cases a complete remission has been induced by a single injection, this does not always occur, and there is a wide individual variation in response. As with American workers, it has not been found possible to correlate these variations in response with age, sex, severity or duration of disease or any specific blood changes. Each patient must therefore be assessed individually. The intravenous route of administration is considered a much more precise method than the oral route, because of an uneven absorption from the bowel. Full remission of all symptoms and signs (including reversion to normal blood picture) for six months or longer was obtained in 20 cases. In four a symptomatic response was obtained, and in one no response.

Radioactive Isotopes in an Applicator for the Treatment of Cervical Carcinoma.

R. C. TUDWAY (*Acta radiol.*, May, 1953) states that many people have sought to improve the dose distribution from radium used to treat carcinoma of the uterine cervix. The essential arrangement in the well-known Paris, Stockholm or Manchester techniques is that of two radium sources, one in each lateral fornix and a central tube in the uterus. The uterus, vaginal vault and parametrium, as far laterally as three centimetres from the mid-line, are well covered by the established techniques when adequately applied. A difficulty is to treat the parametrium beyond the three centimetre mark, and especially the region at the junction of parametrium and pelvic wall. It has been pointed out that to improve the dose at the lateral pelvic wall, compared with the tissues near the uterus, the vaginal radium should be placed in the mid-line—that is, away from the fornices—and the amount of radium increased. This may cause undesirable reactions in the bladder and rectum, unless shielding is arranged between the radium and the bladder and rectum by means of gold or platinum. These points were studied by Neary, who in 1947 produced a design of an applicator of this type. The author suggests that a further advantage would be the use of a radioactive substance such as iridium, which gives out γ rays of less penetrating power than radium, and therefore can be shielded with much smaller amounts of metal. Such an iridium vaginal applicator with appropriate shielding has been worked out at the Bristol Royal Hospital, and the improved dosage distribution to be expected from it is shown in appropriate diagrams.

Radioactive Gallium (Ga^{72}).

M. BRUCER *et alii* (*Radiology*, October, 1953) report a study of the therapeutic use of a radioactive isotope of gallium (Ga^{72}) which was carried out during the years 1949-1951 by the staff of the medical division of the Oak Ridge Institute of Nuclear Studies. The studies involved problems in physics, chemistry, biology and pharmacology, and ended with an assessment of clinical results. The authors state that gallium is obtained as a by-product of aluminium and zinc processing; and of all the gallium isotopes, only those with half-lives of 14·3 hours and 78 hours (Ga^{73} and Ga^{67}) are useful for application to patients. The conclusions reached on Ga^{73} do not necessarily hold for Ga^{67}. The toxicity of various compounds was investigated in rats, dogs, swine and man. The distribution and excretion patterns and metabolic behaviour were studied in approximately 400 animals of five different species. Finally the isotope was used in test doses in 34 patients with various types of cancer, the main groups having osteogenic sarcoma with metastases to the lungs or extensive plasmocytoma. The remainder had soft tissue tumours with metastases in bone. The authors are of the opinion that Ga^{72} is not a therapeutic agent in cancer of bone for the following reasons: (i) Although the isotope was highly concentrated in many areas of tumour, in every case areas of low concentration occurred. (ii) Because of the short half-life of the isotope, the relatively high concentration in tumours develops after most of the radiation energy has been expended. (iii) Undesirable total body irradiation effects become prominent at subtherapeutic dosage levels. (iv) Development of chemical gallium toxicity was a limiting hazard in long-continued dosage.

MEDICINE.

Pulmonary Tuberculosis.

M. R. GEAKE AND F. H. YOUNG (*Thorax*, June, 1953) discuss the prognosis for the contralateral lung after resection of a lung for pulmonary tuberculosis. They review 101 patients who survived operation for three months; 82 were said to have satisfactory results, and 11 had recurrences in the other lung within twelve months. Pneumonectomy was performed in 64 cases, in eight of which the result was unsatisfactory. The term unsatisfactory indicated deterioration in the contralateral lung, and this result was recorded in 11% of 101 patients.

Posterior Infarction of the Heart.

L. WOLFF *et alii* (*Am. Heart J.*, July, 1953) found that posterior infarction of the heart was not diagnosed by the electrocardiogram in 39 out of 86 proven cases. In six of the cases the failure was due to left bundle-branch block, and in 21 cases it was due to the coexistence of acute anterior infarction. The vectorcardiogram appeared to be superior to the electrocardiogram for the diagnosis of posterior infarction of the heart.

Industrial Absenteeism.

NORMAN PLUMMER AND LAWRENCE E. HINKLE (*Ann. Int. Med.*, July, 1953), having shown in a previous study that the greater part of industrial absenteeism was due to a relatively small number of employees, describe the characteristics of the average "high-absence" person as compared with the "low-absence" employee.

Porphyria.

A. J. KERGIN (*Canad. M. A. J.*, August, 1953) describes three cases of intermittent porphyria and states that the disease can simulate any intra-abdominal surgical disease. Other features which may be present are a family history of the disorder, neurological and psychotic disturbances and the passage of dark urine.

Peritoneoscopy.

SAMUEL J. ZOECKLER, PHILIP G. KEIL AND GEORGE J. HEGSTROM (*J.A.M.A.*, August, 1953) review the results of peritoneoscopy in 84 cases. Metastases were demonstrated in more than half of the patients suspected of having only localized newgrowths. The authors strongly advocate use of the technique as a safe and useful diagnostic procedure.

Gastric Ulcer and Carcinoma.

L. L. HARDT, D. F. STEIGMANN AND A. WEISS (*Am. J. Digest. Dis.*, September, 1953) state that one should not rely on the opinion of the radiologist alone, or of the gastroscopist alone, but examine all gastric lesions by both techniques. They support their advice with the results of investigations in 203 cases. They state that both benign and malignant lesions are misdiagnosed more frequently when X-ray or gastroscopic examination is used alone than when both are used.

Rheumatism and Arthritis.

WILLIAM D. ROBINSON *et alii* (*Ann. Int. Med.*, September and October, 1953) give a comprehensive account of rheumatism and arthritis, including arthritis due to specific infectious agents such as gonorrhœa, brucella, ratbite fever and many others, the adrenal cortex and rheumatic diseases, rheumatic fever, rheumatoid arthritis, ankylosing spondylitis, osteoarthritis, sciatica and gout. This is the tenth review of the Editorial Committee of the American Rheumatism Association and is concerned with the literature which has appeared on this subject from 1946 to 1950.

XUM

Medical Societies.

THE UROLOGICAL SOCIETY OF AUSTRALASIA.

THE sixth annual meeting of the Urological Society of Australasia was held at Surfers' Paradise, Queensland, from April 20 to 23, 1953.

Retiring President's Address.

DR. J. J. POWER (Brisbane) in his retiring president's address advocated the formation of a bladder carcinoma register, and discussed the site of the next annual general meeting of the society with reference to its being held away from the capital cities.

Election of Office-Bearers.

The following office-bearers were elected for the year 1953-1954:

President: Dr. Colin Edwards.

Past President: Dr. J. J. Power.

Vice-President: Dr. J. B. Somerset.

Honorary Secretary: Dr. Hugh Pearson.

Honorary Treasurer: Dr. J. W. S. Laidley.

Members of the Executive: Dr. K. L. H. Kirkland, Dr. D. C. Trainor, Dr. L. D. Wheeler.

Induction of President.

Dr. J. J. Power inducted Dr. Colin Edwards the President for the year 1953-1954.

Renal Pain.

DR. J. PETERS (Melbourne) read a paper entitled "The Diagnosis and Treatment of Renal Pain" (see page 162).

Cystourethrography.

DR. B. M. DE LAMBERT and DR. N. F. GREENSLADE (New Zealand) presented a paper entitled "Cystourethrography in the Male" (see page 159).

DR. HENRY MORTENSEN (Melbourne), in opening the discussion, said that he believed cystourethrography to be a method of diagnosis which was used much more frequently than in the past, but he thought that its advantages in the diagnosis of conditions in the lower part of the urinary tract were not sufficiently appreciated. It provided an atraumatic, aseptic method of determining the degree and site of bladder neck obstruction and the amount of residual urine. It rendered the diagnosis of diverticulum of the bladder much more positive, with regard to size, position and degree of emptying, than any other method of investigation. In combination with excretion pyelography it permitted the relationship of the ureter to the diverticulum to be accurately estimated. When it was used in combination with the micturition film, a neurogenic bladder disorder became obvious. The method was used extensively in certain clinics as a means of estimating the degree of infiltration of a bladder carcinoma. It further accurately delineated the position, length and calibre of a urethral stricture and demonstrated the almost invariable dilatation of the prostatic ducts, the so-called "cavitary" prostatitis with which a chronic stricture was associated. For all those reasons it should be used as a routine method of investigation in all suspected cases of disease of the lower part of the urinary tract.

Infertility.

Female Infertility.

PROFESSOR G. SHEDDEN ADAM (Brisbane) read a paper entitled "Observations on Female Infertility" (see page 164).

Infertility in Livestock.

PROFESSOR T. K. EWER (Brisbane) read a paper entitled "Infertility in Livestock" (see page 166).

Male Sterility.

DR. H. H. PEARSON (Sydney) read a paper entitled "Some Aspects of Male Sterility". (This paper has not been submitted for publication.)

Discussion.

DR. R. J. SILVERTON (Sydney) said that in cases of arrested maturation there were masses of interstitial cells. He asked whether female hormones had been used in treatment.

Professor Shedden Adam pointed out that statistics showed that the percentage of infertility in animals was about the same as that of infertility in human beings. He thought that polycystic ovaries could be produced by excessive treatment with pituitary gonadotrophin, and considerable care was necessary. He was concerned about the present position of treatment of the subfertile male. There seemed to be little agreement on the standard of reports, and considerable variation. Apparently a high proportion of normal forms was important, and if "rebound" therapy was employed results might be better. Professor Shedden Adam did not think that contraceptives played an important part. The watch-spring pessary caused cervicitis, but it was little used now. Chemical contraceptives and diaphragms were probably merely innocuous. *Coitus interruptus* was largely practised; it could cause common chronic congestive states and perhaps imperfect development of the Graafian follicle with polycystic ovaries, but it did not appear to have on the female any effect comparable with the damage caused to the male. He wondered how important was the role of pyospermia and what was the value of prostatic massage *et cetera*. He recommended the advice "holidays before hormones".

Professor Ewer, in reply, admitted that tuberculosis was found in the testes of the bull, but said that its incidence was low and that it was being eradicated. He referred to experiments in which sterility was caused in the ram by insulating the scrotum, and said that thyroxine had been found to increase fertility, presumably through its effect on general metabolism.

Tumours of the Adrenal Gland.

DR. K. L. H. KIRKLAND (Sydney) read a paper entitled "Tumours of the Adrenal Gland" (see page 170).

DR. PETER ROW (Brisbane) said that that the present was no doubt the adrenal age. Potassium was now the really important ion. The words "stress" and "adaption" were bandied about, and surgeons everywhere were studying the approach to the adrenal glands. So far had knowledge of biochemistry progressed that it would be disgraceful for any surgical patient to die unless he was in perfect electrolytic equilibrium.

Tumours of the adrenal cortex comprised a most interesting group. They were not common, but as they were associated with striking changes in metabolism, electrolytic balance or endocrine disturbance, they were not likely to be overlooked. This observation did not apply, however, to tumours of the adrenal medulla, especially those arising from chromaffin tissue. Much space was devoted to the subject of phæochromocytoma in urological journals. Dr. Row felt sure that some of these were overlooked as indeed one case which he would present would illustrate.

The clinician nowadays had to eliminate renal hypertension, coarctation of the aorta and pheochromocytoma before deciding that his patient was suffering from essential hypertension.

Interest in the surgery of the adrenal gland was also aroused by reports of attempts to stay the progress of prostatic carcinoma which had become resistant to œstrogen therapy. Now that cortisone, ACTH and DOCA were available, the post-operative management of a patient after adrenal surgery was a little less hazardous than formerly. Even bilateral adrenalectomy could be performed with some prospect of success.

Dr. Row then showed skiagrams, photographs and specimen of a small boy of three and a half years whose history included attacks of violent temper. At two and a half years of age growth of pubic hair had been noticed and downy hair appeared on his arm and back. The patient had looked more mature than his years and he had a prominent abdomen and florid appearance. His systolic blood pressure was 130 to 140 millimetres of mercury. A twenty-four-hour specimen of urine was found to contain 36·7 milligrammes of 17 ketosteroids. His serum chloride and potassium contents were within normal limits and he had a slightly diminished tolerance to glucose. An excretion pyelogram combined with perirenal air introduced presacrally revealed a definite tumour above the right kidney. At operation the tumour had been successfully removed and this was followed by considerable clinical improvement. Six months after operation urinary excretion of 17 ketosteroids had dropped to 1·4 milligrammes in twenty-four hours.

This small patient had a "mixed" type of syndrome. Some of his symptoms and signs had followed the androgenic pattern and others including elevation of the blood pressure conformed to Cushing's syndrome. Dr. K. B. Fraser had kindly allowed Dr. Row to demonstrate this case which he had already reported elsewhere.

Dr. Row's second case history was lent to him by Dr. Morgan Windsor. The patient was a man, aged forty-three years, who underwent an operation for a carcinoma of his right lung early in 1953. The operation had not been successful, as the tumour was too extensive, and the patient died soon afterwards. The specimen, a large phæochromocytoma of the left suprarenal gland, was discovered at autopsy by Dr. J. I. Tonge. The patient was known to be hypertensive before his operation. His systolic blood pressure had on one occasion been 190 millimetres of mercury and his diastolic pressure 110 millimetres. The first case was presented mainly as an example of the value of presacral pneumography in the pre-operative diagnosis of adrenal tumour, and the second case illustrated the fact that phæochromocytomata might be unsuspected in cases of hypertension.

Dr. Greenslade discussed the case of a female patient who had a moderately large mass in the upper part of the abdomen. It turned out to be an enormous teratoma arising in an adrenal gland.

ACTH and Cortisone in Urology.

DR. DOUGLAS B. DUFFY (Melbourne) read a paper entitled "ACTH and Cortisone in Urology" (see page 177).

DR. I. F. POTTS (Sydney) described a case of *osteitis pubis* treated at Sydney Hospital. The patient was aged fifty-six years, and the prostate was the site of a benign adenoma with small abscesses. Diathermy, short-wave therapy and various other forms of treatment were tried without effect. He was then given cortisone, a start being made with 200 milligrammes per day, then 150 milligrammes, and then 100 milligrammes per day for nine days. The amount was then gradually reduced to 25 milligrammes per day. The patient felt better after one day's treatment. In two days he was walking well. However, three months after cessation of treatment he had a relapse. The relapse consisted of the occurrence of some pain in the left ischial region, but it was not so severe. The disease lasted about five months. It was considered that cortisone had given the patient much relief without affecting the actual cause of the disease.

Dr. Mortensen recalled a recent letter received from a urologist in Texas, who had achieved some success in treating Peyronie's disease by injecting cortisone into the plaques.

Dr. Pearson then described five cases of tubular nephrosis, in which diuresis occurred within twenty-four hours of cortisone treatment. He said that one effect that had not been mentioned was on the permeability of the capillaries. The œdema was rapidly relieved, but in one case the patient died. The extreme shock of such cases was also relieved by the treatment. Cortisone, ACTH and nor-adrenaline were all used.

Dr. Duffy, in reply, said that the physician also gave cortisone for long periods—for example, when treating rheumatoid arthritis. Little trouble was encountered when small doses were employed, even when out-patients were treated and without daily weighing of the patient. He thought it probable that much more could be done to ameliorate the symptoms of *osteitis pubis* by similar methods.

Translumbar Aortography.

DR. I. F. POTTS (Sydney) read a paper entitled "Translumbar Aortography" (see page 173).

Dr. H. N. Mortensen said that in New Orleans he had seen a child who had a systolic blood pressure of 210 millimetres of mercury. An aortogram revealed two aneurysms of the renal artery. He thought that aortography should be of considerable value, especially in the examination of patients who presented with hypertension and a normal pyelogram.

The Surgery of Urethral Obstruction.

DR. R. J. SILVERTON read a paper entitled "The Surgery of Urethral Obstruction" (see page 149).

DR. G. R. DAVIDSON (Ballarat) said that although the subject under discussion was "The Surgery of Urethral Obstruction", Dr. Silverton had limited his paper essentially to the treatment of strictures. This was obviously a wise decision, because, firstly, the subject was too vast to be encompassed in a single paper, and secondly, and just as obviously, Dr. Silverton had had a very wide experience in this type of work. He had discussed with a wealth of practical detail the methods that had obviously given good results in his hands and had also reviewed and discussed the work of others.

Dr. Davidson said that he had had early urological associations with All Saints Genito-Urinary Hospital, London. Strictures were common in those days, and it was taught in that hospital that, given time, patience and the correct treatment, most strictures could be not only relieved, but cured, by dilatation alone. Briefly, the treatment consisted in the use of "guides and followers", bougies and occasionally indwelling rubber catheters as described by Dr. Silverton. When the urethra had been dilated to take a number 20F, further stretching was continued by using either the straight or curved Kollmann's dilator. With those instruments, of course, all parts of the urethra except the meatus could be dilated to admit up to number 40 on the Charrière scale, and it was held that cure of a urethral stricture depended on the gradual and intermittent dilatation of the affected portion or portions of the urethra beyond their normal limit without bleeding, which brought about progressive subepithelial rupture and absorption of the fibrous tissue which had been formed. Treatment was carried out every two to three weeks, and the intervals were lengthened when the stricture could be dilated to admit up to number 40F without the occurrence of any bleeding. A check was kept on the patient for five years. Dr. Davidson said that many urologists did not favour the use of the Kollmann dilator; but it was his opinion that, if it was used correctly, with care and patience, good results could be obtained. Dr. Davidson went on to say that from his own point of view, he thought the main indications for operation were the following: (i) inability to pass any instrument when retention of urine had occurred; (ii) inability to pass a guide or filiform bougie after two or more attempts; (iii) in cases of very resistant stricture, in which no headway was made with dilatation, or when severe constitutional symptoms occurred after each dilatation, or if renal failure was developing; (iv) in the presence of extravasation, abscess or complicating disease of the bladder or bladder neck. Dr. Silverton had pointed out that as the years went by, inflammatory strictures would become less and less common. To a certain extent, however, that desirable state of affairs could be counterbalanced by the occurrence from time to time of traumatic strictures developing after endoscopic resection of the prostate. Granted that on the vast majority of occasions that could be prevented by introducing the instrument through the perineum, yet it seemed that sometimes, even when all the rules had been followed, a stricture might still develop. Some urethras were intolerant to instrumentation, and the presence of an indwelling catheter for even a short time seemed to be capable of causing the formation of a traumatic stricture. Dr. Davidson supposed that all urologists had had to deal with the problem of the patient who complained that his catheter or Foley's bag was causing pain. Examination would show that the penis was slightly swollen and tender, and a slight muco-purulent urethral discharge was present. He had heard it suggested that sometimes those reactions were due to tissue sensitivity to rubber, and he thought that that was a likely explanation. The use of some inert plastic such as polythene for urethral drainage might well be the answer to that problem.

The management of strictures occurring after intrapelvic rupture of the urethra could occasionally be extremely worrying. If the original damage had been extensive and the patient was a child, the problem became a very difficult one and perhaps could be solved only by ureteral transplantation. Dr. Davidson said that he would be interested to hear from Dr. Silverton whether he had had experience of his "coring-out" operation in cases of that kind.

Dr. Davidson then said that some mention should be made of congenital urethral strictures. In his opinion, they were not uncommon, were frequently missed and were capable of causing an immense amount of damage. Meredith Campbell stated that in his experience urethral stricture accounted for one-fifth of the urological disorders of childhood. All urologists were familiar with pinpoint stenosis of the external meatus; but a high percentage of other members of the medical profession completely overlooked it, or forgot it. A proper appreciation of its frequency of occurrence and its ease of rectification would forestall countless episodes of urinary infection and damage to the upper part of the urinary tract.

Other urethral strictures of a congenital nature could occur, very rarely at the peno-scrotal junction, and more often in the membranous urethra. In the prostatic urethra, the much discussed valves could and did occur. Dr. Davidson was certain that these valves were definite entities and for practical purposes they were strictures. Occasionally an almost complete diaphragm existed; more often they took the form of cusps or cups, the medial ends of which were attached to the verumontanum. Since the lesion was obstructive, it should sooner or later be discovered in any

large series of children who were examined for chronic urinary infection, enuresis *et cetera*. These congenital obstructive lesions could cause damage *in utero*, and the prognosis and treatment must be always considered in terms of kidney function. Diagnosis was not particularly easy. Dr. Douglas Stevens, working at the Children's Hospital, Melbourne, had interested himself in the problem and held that the micturition urethrogram was of great diagnostic value. He had a most interesting series of X-ray films to prove his point. Meredith Campbell advocated the use of a direct vision instrument, the valves being observed as the cystoscope was being withdrawn from the bladder, a gentle stream of water running through the instrument at the time. The valves were often torn by the passage of the instrument or by preliminary sounding. Treatment was best carried out by endoscopic resection.

Finally, Dr. Davidson again drew attention to the fact that urethral strictures in the female were not at all uncommon. He had heard it said that the late Dr. Bridge held that a Kollmann dilator paid better dividends in female urology than any other instrument. That was exaggeration perhaps, but not a gross one. It was easy to see that such strictures can occur. Midwifery probably produced the greatest number. Trauma from the oncoming or after-coming head or from instruments, and infection from catheterization during the puerperium, seemed obvious causal factors. Unless the trauma had been extensive, the condition, almost without exception, could be relieved by dilatation.

Dr. Potts said that he preferred the term "watering can scrotum" to "watering pot scrotum".

DR. F. W. R. LUKIN (Brisbane) pointed out that many strictures could be successfully dilated after deviation of the urinary stream by suprapubic drainage.

DR. C. M. EDWARDS (Sydney) said that he had examined a fairly large number of Dr. Silverton's patients, and most had been very successfully treated. Those cases in which the results of treatment were not so successful were those in which stricture of the bulb close to the membranous urethra was encountered.

Dr. Duffy said that the procedure of "coring out" did not appeal to him. He thought that surely there must be a risk of damage to the external sphincter. He preferred to attack it from both ends and leave an indwelling Foley catheter in position for five or six weeks.

Dr. Silverton, in reply, said that in his experience no case of urinary incontinence had been encountered. Most of the "cored out" strictures were in the posterior part of the urethra.

Dr. Pearson said that he preferred a by-passing operation.

Congress of the International Society of Urology.

DR. H. M. MORTENSEN (Melbourne) gave an account of the ninth congress of the International Society of Urology, which had been held from September 15 to 18, 1952, at New York. Dr. Mortensen said that this was the first time that a meeting of the Society had been held in the United States. It had been arranged on two previous occasions, but on the first it had to be cancelled on account of World War I and on the second on account of World War II. Everyone was naturally very concerned some months before the holding of this meeting as to whether it would be cancelled on account of World War III. It was attended by some 250 urologists, a truly representative gathering from all parts of the world. The North Americans, of course, provided the greatest number. However, there were 19 representatives from the British Isles, many from Norway, Sweden, Denmark, Holland, Belgium, France, Germany, Switzerland, Italy, Greece, Turkey, Japan, Egypt and South Africa, and many from the various States of South America. From the social point of view the United States representatives were the hosts, and as could be expected did things in a magnificent manner. Those present lunched each day as the guests of a different scientific firm, there were two banquets and a theatre party, and whilst the language difficulties at these meetings and in the scientific section provided a problem, it was still amazing how many of the representatives of the non-English-speaking countries were able to make themselves understood in English. French was really the official language of the Society, but one of five languages was accepted as a method of presentation: they were English, French, Italian, Spanish and German.

Dr. Mortensen went on to say that the scientific side of the congress dealt, as always, with three subjects: (i) the non-surgical treatment of uro-genital tuberculosis; (ii) vesical carcinoma; (iii) the treatment of anuria.

Uro-Genital Tuberculosis.

The first subject was dealt with by DR. GILBERT THOMAS of the United States, by DR. JEAN CIBERT, of France, by DR. EGON WILDBOLZ, of Switzerland, and by DR. EINAR LJUNGGREN, of Sweden. Dr. Cibert had analysed the results in 510 cases from his private and hospital practice. All these patients had been treated with streptomycin, with or without chaulmoogra oil, with or without PAS. Dr. Cibert said that he had had no experience with any other drugs. A few of the patients had been treated with PAS only. It appeared to him to be impossible to assess the apparent differences in results between the various methods or combinations of treatments. He stressed that the modern medical treatment of tuberculosis did not remove the necessity for "*la cure climatique*", whether in a sanatorium or not. The activity of streptomycin was strictly specialized. Its use was the treatment for the acute lesion of tuberculosis—inflammation with œdema, congestion, superficial ulceration and bacilliæmia (which processes had begun spontaneously or been provoked by surgery)—but it was of no value in sclerosing lesions with caseation and fibrous cavities. He had obtained the following results in the treatment of male genital tuberculosis in 41 cases. Of 39 cases of epididymitis, subacute or chronic, in 27 no result was obtained, and in 12 there appeared to be a favourable result which was never complete. In one case of acute epididymitis rapid regression occurred, but again this was incomplete. He had not performed an epididymectomy under streptomycin "cover". He had observed six cases in which epididymitis had appeared after treatment with streptomycin of a pulmonary or renal tuberculosis. In summary, Dr. Cibert had said that streptomycin and PAS did not cure genital tuberculosis.

Referring to renal tuberculosis, Dr. Cibert had first discussed unilateral tuberculosis. In a series of 161 cases (the longest time for which one patient was followed being three and a half years) medical treatment had given 45 failures, 38 clinical cures and 17 remissions. In the majority of cases the clinical cure seemed assured, with disappearance of pyuria and bacilluria; but the symptoms soon reappeared with generalized cystitis. The maximum free interval was two years and four months. Of 30 nephrectomies performed in the unsuccessful cases, three of them had been partial excisions. In the 15 other cases in which treatment was medical, after an apparent remission of variable duration, generally less than two years, nephrectomy was refused. The antibiotics might produce renal colic when lesions existed in the ureter. Dr. Cibert had said that in the treatment of unilateral tuberculosis by antibiotics, relief of symptoms was certain and often spectacular, the most favourably influenced being those of cystitis. The excretion pyelogram might be modified. In some cases in which renal colic was present, the antibiotics appeared not to have any effect. The general state of health was improved.

Discussing the action on the renal lesions, Dr. Cibert had questioned whether antibiotics cured or modified the evolution of the disease, or whether it was possible to talk about a complete cure with streptomycin. He said that it was difficult to answer that question; but he thought that whilst almost complete sclerosis of the renal lesion might take place, it was still possible for bacilli to be found in or to develop from that position. He quoted a case in which he had resected the upper pole of a kidney, in which a cavity was seen on the excretion pyelogram, from a patient suffering from genital tuberculosis. The lesion appeared to be completely sclerosed, but bacilli were found in it.

Turning to bilateral renal tuberculosis, Dr. Cibert had said that 80 patients had been treated with streptomycin and PAS. There were 36 failures, 29 remissions and 15 clinical cures. In relation to the failures, medical treatment was found to be useless for chronic cystitis. In relation to the remissions, in many cases the patients had been subjected to antibiotic treatment for their renal condition or for other tuberculous lesions, and their streptomycin resistance was therefore raised. They did not receive much benefit from their second course. In relation to the clinical cures, the longest period for which the patients were observed was two years. In the majority of these cases the renal lesions were small and the onset of cystitis was recent. In all these cases the urine was found to be clear, even pus and bacilli having disappeared, but rarely was it found that inoculation gave negative results. Despite all the failures and the partial results, antibiotic treatment in cases of bilateral renal tuberculosis had a proportion of successes. Dr. Cibert's further observation was that streptomycin and PAS treatment produced no result in the contracted bladder. It acted upon the superficial lesions which were reasonably recent. The persistence of renal lesions was a bar to the medical cure of cystitis. In his hands streptomycin had lowered

the mortality of nephrectomy from 6·39% to 2·1%. It had increased the primary healing rate from 19% to 62%, and vesical cures from 52% to 66%. Streptomycin considerably improved the immediate and late prognosis of nephrectomy.

With regard to partial nephrectomy, Dr. Cibert had said that streptomycin rendered conservative surgical treatment possible in tuberculosis. He had performed that operation in 19 cases, in four of them on a solitary kidney. The mortality rate was 10·5%. Seven of the cases were simple, and in ten complications independent of the operation were present, such as pneumothorax or pulmonary atelectasis. In six cases a lumbar urinary fistula had developed, accompanied in one by severe infection of the wound, and secondary hæmorrhage occurred in one case. Three patients had previously had courses of streptomycin and become streptomycin-resistant. The wound broke down eventually and secondary nephrectomy became necessary.

Dr. E. Ljunggren, of Gothenburg, Sweden, had read an excellent paper on the non-surgical treatment of uro-genital tuberculosis. In his introduction, discussing the intimate relationship between genital and urinary tuberculosis following on the lecture by Wildbolz in 1939, he had drawn attention to the fact that the spread within the uro-genital system could take place with reference to time and place *"avec une fantaisie"* which defied all foresight and prediction. He said that it often seemed that a certain antagonism existed between the development of tuberculosis in the kidney and in the genital organs, severe epididymitis being seen with an old sclerosed focus in a kidney. He had seen small lesions in the kidney with pronounced cystitis or bilateral renal tuberculosis without cystitis. He believed that cystitis and renal tuberculosis even in an advanced state were less frequent in Sweden now than formerly, and believed that to be due to a change in the character of the tuberculous infection, probably from increased resistance. There was no evidence that spread from the kidney to the genitalia had diminished, genital lesions occurring in 84% of 112 male patients who had undergone nephrectomy. Dr. Ljunggren had said that removal of an infected kidney rarely influenced the progress of a coincidental genital lesion, but instead there appeared to be an increased incidence of epididymitis in the year immediately after nephrectomy for tuberculosis. An examination of comparatively recent figures compared to those of 25 years ago, of cases from Stockholm, did not show any increase in the percentage of patients remaining healthy after nephrectomy. Dr. Ljunggren had made the following statement:

> Our endeavours to improve the results of our treatment of renal tuberculosis through early diagnosis and early operation have thus far not been rewarded by the success anticipated.

Linden had shown, with regard to men, that the result was poorer when there were minor lesions in the kidney than when a moderately extensive lesion existed. Dr. Ljunggren said that one reason why the results had not been improved was because renal tuberculosis was regarded as a local surgical disease and not as a local manifestation of a general disease, and he stressed the importance of sanatorium treatment. The watchword, therefore, should not be early nephrectomy, but nephrectomy at the most suitable period. Since the progress of the disease varied from patient to patient, progress often alternated with regression with longer or shorter periods of stability. The process sometimes extended only over some months, but also for years.

Dr. Ljunggren also discussed the pathogenesis of renal tuberculosis and its place in the course of tuberculous infections. He mentioned the parenchymatous stage of the French, what Rigos called the non-destructive stage of renal tuberculosis, and what was otherwise generally referred to as subclinical tuberculosis as elaborated by Band. The disease in that period of development was subjected to cure and capable of diagnosis, particularly in those patients suffering from tuberculosis elsewhere. Dr. Ljunggren said that even the ulcero-cavernous type of tuberculosis could sometimes heal spontaneously by the occlusion of the affected calyx, and again drew attention to the words of Linden. He was able, ten to twenty-eight years after operation, to show by urography in a number of patients operated for renal tuberculosis or tuberculous epididymitis, small cavities in one of the kidneys or in the remaining kidney after nephrectomy, the urine meanwhile being clear and cultural examinations and inoculations giving negative results. All patients in Sweden suffering from tuberculosis were reported to the tuberculous dispensary and kept under control until the disease was considered healed. Routine inoculations of the urine were made, and if the results became positive the patient was sent for special urological examination. A consulting urologist was attached to the tuberculous dispensary in all big cities. Gothenburg was a city of 340,000 inhabitants, the patients from which received sanatorium treatment at Ravalden Sanatorium, where a genito-urinary service of 40 beds had been established. Many of the patients operated on for surgical tuberculosis in one kidney might easily have the subclinical type of tuberculosis in the other kidney, and the treatment and cure of such subclinical lesions by means of chemotherapy might prove to be one of the greatest gains in its introduction.

In the case of unilateral tuberculosis in the ulcero-cavernous stage, when operation was decided upon, the pre-operative course of chemotherapy was seldom of less than two months' duration. When there was any possibility of the existence of tuberculosis in the parenchymatous or subclinical stage which had not yet healed, the patient was kept under prolonged treatment to remove the danger that the bacillæmic phase of tuberculous infection was not yet completed. In some cases of advanced tuberculosis in which little effect could be expected from chemotherapy, a very short pre-operative course was used. In cases of unilateral disease in which there were only minor lesions in the kidney, such as an isolated ulceration of one papilla without cystitis, an attempt was made to cause the process in the kidney to heal by merely giving a long course of chemotherapy and sanatorium treatment. If the lesions were somewhat more advanced and situated in one of the poles of the kidney, or if minor lesions situated in that region showed no tendency to heal with chemotherapy and sanatorium treatment, a partial nephrectomy was carried out. In such cases a prolonged pre-operative course of chemotherapy was given (at least six months), and it was considered an advantage if operation could be postponed till the animal inoculation test gave negative results. In more advanced lesions of the kidney a nephrectomy was carried out. If the ureter was involved, particularly if there was a stricture in the lower portion or a vesico-ureteral reflux appeared, total ureterectomy was performed as well by a separate incision in the mid-line. If renal tuberculosis was associated with active tuberculosis elsewhere, nephrectomy was not carried out as a rule before these lesions were controlled. Exceptions were mainly patients with a badly damaged kidney in which there was secondary infection, since removal of such a kidney could improve the patient's general condition and increase his ability to heal the extra-urogenital lesions. After operation the patients received sanatorium treatment with chemotherapy, which was continued, if possible, until the animal inoculation tests gave negative results. In that regard four successful" negative" inoculations at intervals of six weeks were required. In bilateral renal tuberculosis the treatment consisted solely, in most cases, of chemotherapy and sanatorium treatment and the same was the case in conditions of tuberculosis in the remaining kidney after nephrectomy. In those cases the chemotherapy was often of long duration, and as a result of it Dr. Ljunggren was more and more inclined to perform operation on the advanced lesions or maybe a partial nephrectomy on each side.

In cases of coincident genital and renal tuberculosis, it was the latter that claimed attention, although a larger dose of PAS was generally given under those circumstances. The treatment of patients with only genital tuberculosis followed the principles elaborated for renal tuberculosis. Tuberculous epididymitis was generally treated surgically. Only in those cases in which the condition had become completely sclerotic and appeared to be healed was surgical intervention not proceeded with.

The medicaments used in chemotherapy were PAS, "Canteben" and streptomycin, rarely chaulmoogra oil and vitamin *D*. The blood supply was of decisive importance for the therapeutic effect on tuberculous foci, but in the urinary system tuberculostatic drugs could exercise their influences through the urine. PAS was found in the urine in a tenfold higher percentage than in the blood. PAS had been introduced by Lehmann, of Sahlgrenska Hospital, and at the beginning (from 1946) that remedy was used solely. It was believed that streptomycin had the strongest effect, but that it also carried with it the greatest risk of development of resistance towards it. The results were tabled of an investigation of 200 cases. The mortality rate during the first year dropped from 10% to 0·7%. Miliary tuberculosis after operation had been almost completely eliminated. Whereas formerly in at least 30% of cases primary healing of the wound was not obtained, now failure was a rarity. Of 94 cases of tuberculous epididymitis operated on without an "umbrella" of chemotherapy, in 53% complete healing had not occurred after a time lapse of five weeks. In his material of 27 such operations with "umbrella", imperfect healing at this time occurred in only

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two cases, and in neither of these two cases was the patient given streptomycin. Whereas 18 of 112 men developed epididymitis for the first twelve months prior to the use of chemotherapy, no case of epididymitis had been encountered when protection by chemotherapy had been given. Tuberculous cystitis thus decreased gradually or healed rapidly, and when superficial ulcerations were present improvement was also seen with PAS alone, but healing took longer, up to six or nine months. Chemotherapy had no effect on the contracted bladder. The signs of healing found in an exhaustive study of kidneys after conservative treatment by these methods were out of all proportion to those seen in the pre-chemotherapeutic days.

Dr. Wildbolz had commented on the frequency of urogenital tuberculosis in Switzerland, whereas stone was relatively uncommon. There was no provision for the pasteurization of milk in Switzerland, and it was suggested that that might have some relationship to the incidence of the disease. (Figures quoted by Professor Ichikawa, from the Urological Department of the University of Tokyo, Japan, stated that 80% of nephrectomies performed in that hospital were for tuberculosis.) In complicated cases sanatorium treatment was insisted upon for six months with the exhibition of the antibiotics. Dr. Wildbolz was sure that streptomycin was not the best of the antibiotics, and believed that some of the carbamide group combined with chaulmoogra oil would be better. The combination favoured at the moment was that of thiosemicarbazone with chaulmoogra oil. As an indication of the frequency of the existence of the disease, he said that he himself had a sanatorium with 65 beds for the treatment of genito-urinary tuberculosis. In uncomplicated cases he used no antibiotics immediately prior to nephrectomy. Of the patients 33% developed fistula after leaving hospital. He did not perform ureterectomy as a routine measure because of the increase of the morbidity and mortality of the operation. If it was necessary he performed it in two stages. When hydronephrosis developed in the contralateral kidney owing to the cystolic bladder, a ureteral transplant of the Nesbit type was performed, but preceded by nephrostomy for the purpose of cultural examination of the urine. The transplant was undertaken only if the culture gave negative results. If not, a cutaneous ureterostomy was performed, and it had been noticed that after a period of drainage alone the culture result might become negative. His results with chaulmoogra oil alone had been more satisfactory than those of any of the other people with whom the matter was discussed.

In discussing the question of partial nephrectomy for tuberculosis, Dr. Latimer, of New York, who had had a large experience of the operation, said that it was not necessary to arrange the incision so that cut kidney substance was opposed to cut kidney substance at the end of the operation. The capsule of the kidney was reflected, the portion to be removed was dissected out across the kidney with the blunt end of a scalpel, leashes of vessels near the pelvis were identified and tied, and the capsule was then brought across the cut end of the kidney and sutured.

Vesical Carcinoma.

The subject of the treatment of cancer of the bladder had been discussed by Dr. Higgins, of the United States, by Dr. Terence Millin, of Great Britain, and by Dr. Surraco, of Uruguay.

Dr. Higgins had stressed the point that the introduction of the newer therapeutic refinements in anæsthesia and operative techniques and an adequate pre-operative and post-operative regimen promised operative procedures of considerable magnitude accompanied by a lower operative mortality and a reduction in the morbidity. It appeared to him that the urological surgeons employed more conservative treatment for the relief of early carcinoma of the bladder, and in instances in which such procedures might be no longer utilized advocated cystectomy. A review of 1312 patients with carcinoma of the bladder by the Carcinoma Registry of the American Urological Association revealed that only 11, less than 1%, had been treated by cystectomy. Dr. Higgins stressed the importance of early recognition of the disease, and again referring to the Registry, stated that in 48·3% of cases the diagnosis had not been established until more than a year after the appearance of the initial symptom of hæmaturia, which was the primary initial symptom in 60% to 90% of cases. He suggested that time and energy should be expended on the education of the public concerning the gravity of hæmaturia. Discussing the location of tumours, Dr. Higgins said that complete segmental section of the bladder including the tumour without injury to the ureters or sphincter was technically impossible in 72% of cases. He mentioned that the degree of malignancy varied in different parts of the bladder, the highest being in neoplasms in close proximity to the urethral orifices or in the vault. He drew attention to the difficulty encountered in the correct grading of bladder tumours, and to the fact that in only 60% of cases sent to the Carcinoma Registry was the original grading acceptable to the pathologists of the Registry. Papillary carcinoma of the bladder might be primary or might develop from a papilloma, and the gradation of the tumour on the basis of dedifferentiation alone did not suffice from the standpoint of prognosis. In each case it was necessary to determine the histological grading, the cell type, the degree of penetration of the wall of the bladder or perivesical fat, and finally the presence or absence or involvement of the veins or lymphatics. He put forward a plea for earlier and more general cystectomy with pelvic gland dissection on the following grounds: (i) A favourable age group was being dealt with. (ii) Approximately 50% of the tumours were papillary carcinomata. Of that group 70% to 75% were in Grade I or II. (iii) As a result, the majority of tumours in that group had no extension into the perivesical fat and therefore had a high potential of curability. (iv) From a post-mortem study it might be stated that early in the course of the disease the neoplasm was confined to the bladder. (v) Lymphatic drainage was favourable in the radical removal of the pelvic lymph glands. (vi) The operation was followed by low mortality and morbidity. At the present moment Dr. Higgins advocated cystectomy for all Grade II, III and IV infiltrating carcinomata of the bladder and for papillary non-infiltrating tumours involving the ureteral orifices. Dr. Mortensen said that the figures presented by him for a series of 68 patients were not very stimulating. Sixteen of the 68 patients had died from other diseases. Of the 52 left, 32 were living and well with no evidence of recurrence or metastases; but the longest period mentioned was in the neighbourhood of three years, and most of the periods were considerably less than that.

Dr. Terence Millin had discussed the subject mainly from the aspect of clinical pathology. He entered a plea for the careful management of the operative specimens, stressing the necessity for distension of specimens after total cystectomy prior to fixation. He mentioned that in one or two instances pathologists had missed a carcinoma of the bladder in such a specimen not distended and in the specimens obtained from segmental resections; these should be opened out on a flat piece of cork and fastened to a frame prior to fixation. He had drawn attention to the importance of multiplicity of lesions in prognosis and to the importance of multiple small papillary tumours which, on closer inspection, contained small solid nodules in between the papillary fronds. That finding indicated a lymphatic spread and a degree of malignancy much greater on microscopic examination than the original papillary character would suggest. The cystoscopic assessment of lesions on or around the vesical outlet led to many pitfalls. The general tendency was to assume that tumours were of very much greater size in that region than was found on open operation. Dukes and Millin and one of his associates had adopted a classification little different in terminology from that adopted in America. They still recognized the benign papillary tumour. They distinguished the papillary transitional-celled tumours from the solid transitional-celled type. They differed in appearance, and the solid type was much more lethal than the papillary. Metaplasia in a tumour was a feature which they associated with an increase in the malignant nature of the lesion. The transitional-celled tumour with areas of metaplasia was distinguished from the pure metaplastic tumours, which were the purer adenocarcinomata and squamous-cell carcinomata. Even if there were cell nests in a transitional-celled carcinoma, it should not be confused with pure squamous-celled carcinoma. The latter was frequently the sequel to long-standing infection with leucoplakia. That was slowly growing and appeared to respond poorly to radiation therapy, whereas the transitional-celled carcinoma with squamous-cell metaplasia behaved in exactly the opposite manner.

Dr. Millin had mentioned that in discussing the degree of spread it did not appear to be sufficiently widely appreciated that the vesical ends of the ureters, particularly the submucous and intramural portions, were prone to develop tumours. That condition was to be suspected when, on bimanual examination, the bladder tumour was not palpable as an infiltrating lesion, but was associated with dilatation of the upper part of the urinary tract on that side. Once tumour commenced to invade the muscularis in the region of the internal urinary meatus, the speed with which it was disseminated was out of all proportion to the degree of infiltration of the main tumour. He stressed the importance of using biopsy studies in association with other factors in

the case. Of interest in treatment were two relatively new types of irradiation therapy utilized for essentially different types of tumour. The first was that of intracavitary irradiation for multi-focal superficial carcinomatosis. He mentioned the disadvantages of irradiation by radium element or radioactive cobalt in the centre of an air-filled balloon. Firstly, the muscle received almost the same dose as the mucosa, owing to the gradual falling off of dosage with depth, and secondly, if the focus of irradiation was not kept accurately in the centre of the balloon, the irradiation might be grossly uneven. A bag filled with a solution of radioactive salt did not have that disadvantage, and by the use of bromine, a high homogeneous irradiation for a distance of five millimetres outside the surface of the bag and a steep falling off in dosage beyond that distance could be achieved. The solution was left in place for one hour, and the treatment was repeated at weekly intervals for three applications, each of which aimed to administer 2000*r* of γ irradiation and 400*r* of β irradiation. That form of therapy was reserved for multiple mucosal carcinomata with no abnormality in the urogram and no palpable thickening. The other new type of therapy was the introduction of activated tantalum wires. They had been employed in the case of the solitary pedunculated papillary or solid transitional-celled carcinoma more than two centimetres in diameter. The bladder being opened, the tumour was sucked into a glass thistle funnel to avoid spilling of tumour cells and maintained in that position by suction whilst the pedicle was clamped and cut with the diathermy knife. Tantalum wire was used, activated in the atomic pile to the strength of one millimicron per centimetre length, shielded in platinum for β radiation. The wire was very flexible, like fuse wire, had a half-life of 120 days so that it could be kept for use for a considerable time on a strength of therapeutic value, and could be reactivated by a second exposure to the atomic pile. The wires were introduced on a modified "Boomerang" needle holder, in which two hollow groove needles were mounted one centimetre apart, through which a hairpin of wire was introduced after the needles had been placed at the tumour base.

Upper Renal Tract Hæmaturia.

DR. COLIN EDWARDS (Sydney) reported a case of "Upper Renal Tract Hæmaturia" (see page 180).

Dr. Edwards then described a case of hæmaturia due to a vitamin *C* deficiency. The patient had lived entirely on tinned food and the hæmaturia ceased on the administration of vitamin *C*. It recommenced after he had been for four days taking a diet deficient in vitamin *C*.

Dr. Laidley mentioned a similar case, that of a man who had lived entirely on condensed milk and biscuits. He had every known symptom of renal tuberculosis, and every cystoscopic sign except tubercles. His symptoms had disappeared in five days with an adequate diet, and a cystoscopic examination then gave normal findings.

Dr. Edwards then described the case of a young woman with a persistent defect in an upper calyx, more pronounced than in Dr. Laidley's case. Careful examination of the kidney after its removal disclosed only a small area of round cells and fibroblasts. He said that such changes, if more generalized, would have been consistent with pyelonephritis. However, the rest of the kidney was normal. In that case hæmaturia might have been from the site of a stone that had long since disappeared, or possibly an old lesion resulting from sulphonamide therapy.

Dr. Davidson quoted two cases of hæmorrhage due to unilateral glomerulonephritis. Nephrectomy had been performed in both, and the second patient had had no further hæmorrhage over a period of fifteen years.

Dr. Potts reminded those present that an arterio-venous fistula could occur, and that it could cause bleeding. He said that such a fistula was difficult to demonstrate. He recalled a further case of unilateral hæmaturia relieved by the passage of a ureteric catheter and running in thrombin. A course of treatment with "Rutin" had produced no improvement. Dr. Potts pointed out that there was a risk of aplastic anæmia if hæmorrhage was allowed to continue for a long time.

Dr. Lukin and Dr. Mortensen reported further cases in which hæmorrhage was apparently due to unilateral nephritis, and in which clinical cure over a long period had followed nephrectomy.

Dr. Pearson and Dr. Silverton drew attention to angiomata as a cause of hæmorrhage. Dr. Silverton, in cases thought not to be serious, advised injection of five millilitres of 5% silver nitrate solution into the renal pelvis before radical surgical treatment was carried out.

Dr. Edwards suggested the possibility that some cases of hæmaturia might be the result of sulphonamide therapy, which had produced microscopic renal damage.

Dr. Potts mentioned that hæmorrhage due to an angioma or to a renal infarct might be diagnosed by arteriography.

Clinical Presentations.

Dr. Colin Edwards reported two cases, one of ureteric obstruction resulting from peritoneal adhesions, and one of bilateral hydronephrosis due to hæmatoma following a Manchester operation for uterine prolapse. These cases are reported at page 180.

Dr. Greenslade recalled a similar case in Christchurch, which had followed the operative repair of a uterine prolapse. The patient was anuric and already moribund when the complication was recognized.

Dr. Potts presented two cases, one of *osteitis pubis* following a Harris prostatectomy, and one of extravasation of urine following ureterography.

Dr. Davidson reported a case of reimplantation of the right ureter into the bladder. The patient suffered from hydronephrosis and a dilated ureter resulting from operative damage sustained five weeks earlier.

Dr. Mortensen, in discussing Dr. Davidson's case, pointed out that a catgut ligature might sometimes be absorbed. He said that attempts should be made to traverse the damaged ureter by means of a cystoscope before operation was decided upon.

Dr. Power presented a case of dilated pelvic ureter. He then showed coloured photographs of a premalignant condition of the *glans penis*.

Dr. Greenslade reported two cases. The first was that of a man, aged seventy years, with an unusual carcinoma of the prostate gland presenting as a cystic swelling in the perineum. The second case was one of carcinoma of the prostate with extreme rectal obstruction.

Much discussion followed on the merits and disadvantages of orchidectomy *versus* treatment with stilbœstrol alone. The serum acid phosphatase estimation was also discussed. Some members considered it to be unreliable.

DR. PAUL HOPKINS (Mackay) presented the case of a little girl with megaloureter, and also that of a female patient with hirsutism of adrenal type.

DR. F. R. COYNE (Sydney) reported two cases of cystic kidneys—one of solitary cyst and one of multiple cysts.

DR. C. ROE (Brisbane) reported a case of bladder neck obstruction with a large diverticulum.

Considerable discussion followed on the subject of bladder diverticula. It was generally agreed that in the average case one should first deal with the obstruction, and often radical treatment of the diverticulum itself might not be necessary.

Out of the Past.

In this column will be published from time to time extracts, taken from medical journals, newspapers, official and historical records, diaries and so on, dealing with events connected with the early medical history of Australia.

THE ADMISSION OF PAUPERS TO COLONIAL HOSPITALS.[1]

Colonial Secretary's Office,
Sydney,
12th July, 1842.

The Deputy Inspector-General of Hospitals.

Sir,

I have had the honor to receive and to submit to the Governor your letter of the 7th inst. in explanation of the circumstances under which free paupers are admitted into the Colonial Hospitals without the usual order from this office, and in reply I am directed by His Excellency to inform you that he regrets to be forced to express an opinion that great laxity has been allowed to prevail in the admission of persons into the Colonial Hospitals under the name of paupers and that an unnecessary expense to a considerable amount has consequently been incurred.

[1] From the original in the Mitchell Library, Sydney.

His Excellency desires that yon will give directions that in future no person shall be admitted under this character without the previous order of the Government except in cases of accident or emergency and that every such case be reported within 24 hours after the admission of the patient.

I am further directed to request that you will inform the different officers in charge of hospitals that they will be held strictly and personally responsible for any expense that may be incurred in contradiction of these orders.

Whenever a surgeon in charge of a hospital may admit a patient under a guarantee of payment such guarantee is to be taken in a formal manner and executed by way of Bond before the Police Magistrate or other Justice of the Peace and every such guarantee is to be given by at least two respectable and substantial householders and transmitted without delay to the Government.

I have, etc.,
E. DEAS THOMSON.

Correspondence.

LONG-LASTING LOCAL ANÆSTHETICS: A WARNING.

SIR: The introduction of long-lasting local anæsthetic preparations within the past few years seemed, without doubt, to supply a long-felt want for the relief of post-operative pain and for the relief of pain caused by certain conditions in which relief, usually only temporary and partial, could only be obtained by the administration of morphine, or similar drugs, in ever-increasing dosage.

After many months' experience in the use of "Efocaine", or its Australian equivalent "Staycaine", I came to believe that these preparations were well worth while, particularly in thoracic surgery. In forming this belief, I was particularly influenced by the frequent voluntary statements of patients who had undergone bilateral operations for bronchiectasis. Such patients frequently said, "This time it is much less painful than last time", or voiced some similar expression comparing their experience of post-operative comfort with, and without, the use of long-lasting local anæsthetic preparations.

There were, of course, the minority of patients, mostly with a low pain threshold, who would always complain. However, in the majority of cases, there was a definite reduction in post-operative pain, a definite decrease in post-operative difficulties and a shorter period of hospitalization, during a time in which the only alteration of pre-operative, operative and post-operative routine was the introduction of the use of long-lasting local anæsthetic preparations at the conclusion of the operation.

The technique employed was never varied. A subpleural bleb of two cubic centimetres of the preparation was made in the vicinity of the intercostal nerves above, below and corresponding with the level of entry into the chest. This was always done under direct vision and never more centrally than the tip of the corresponding transverse process. When drainage was employed, the bleb was made, under direct vision, just proximal to the point of entry of the drainage tube, always well lateral to the transverse process. There was never, throughout many scores of cases, any instance of injection other than under direct vision, and there was never any evidence, at the time of injection, that a blood vessel had been damaged at the site of injection.

On October 7, 1953, I operated on a man, aged fifty years, who had a small but recurrently irritating hiatus hernia. The approach was made through the bed of the left eighth rib. Before closing the chest two cubic centimetres of "Staycaine" were injected subpleurally to produce blebs round the seventh, eighth and ninth intercostal nerves. The operation was finished at 4.30 p.m.

At 3 a.m. on the following morning the patient complained that he could not move his left leg. Twenty-four hours later there was complete paralysis of both legs, anæsthesia to the level of the seventh thoracic segment, and loss of bladder and bowel control. The condition has persisted, the inevitable trophic lesions progress, and the patient is dying of toxæmia from his trophic lesions and the inevitable urinary infection.

Since the early days of this disaster I have been combing the available literature and have been in contact with numerous people who might possibly explain the mechanism of this occurrence. No satisfactory explanation is forthcoming.

It is my own belief that the patient presents the picture of an anterior spinal artery thrombosis, but with excessive trophic lesions. In the few cases reported from the United States of America the tendency is to label the condition as a transverse myelitis. As my patient still has posterior column sensation I cannot accept this view.

As soon as I gathered a reasonable store of information concerning the potential dangers of long-lasting local anæsthetics, I notified the manufacturers of the Australian product. It is to their great credit that the product was shortly afterwards withdrawn.

My purpose in this publication is to warn practitioners who may still be employing these preparations of their potential danger in their present formula, which, I understand, is the same under various proprietary names.

Yours, etc.,

262A St. George's Terrace,
Perth,
January 12, 1954.
FRED CLARK.

POISONING FROM A "BENZEDRINE INHALER".

SIR: At 10 p.m. on December 21, at the end of a short but severe heat wave, a man telephoned to say that his son, aged eighteen months, had "a touch of the sun", that he would not go to bed, and in fact screamed whenever attempts were made to put him down.

When the child was seen soon afterwards he was making an almost continuous noise best described as an anxious moan, although not suggestive of pain. He seemed quite oblivious to his surroundings, and made no response to overtures, friendly or otherwise. He did, however, resent any interference with his own feverish activities, which consisted of unpacking and packing an assortment of toys he had brought in a bag.

The parents stated that he had been disinclined to play with the other children since early in the afternoon, that he had vomited three or four times, and that his odd behaviour had persisted ever since the onset.

Examination showed nothing abnormal except moderately dilated pupils.

As his behaviour fell into such a clear-cut pattern, I felt there must be some explanation; but mystification was intense until in a sudden diagnostic brainwave I recalled a letter in your journal, perhaps two or three years ago, written by a Hobart practitioner. The parents were most impressed when asked whether the child had been playing with a "Benzedrine Inhaler" in the bath. They admitted this, and thought the abnormal behaviour started within half an hour of him doing so. They had considered the inhaler to be spent.

Despite one and a half grains of "Nembutal" given in divided doses, the child did not settle down to sleep until four o'clock the following morning.

It is worth noting that the parents regarded the inhaler as harmless, that such inhalers when new contain 325 milligrammes of "Benzedrine", the equivalent of 65 tablets, and that we still regularly receive them in the post.

I would like to thank the writer of the letter to which I have referred, and would be pleased if you could locate and append the reference.

Yours, etc.,

29 Adelaide Street,
Wentworth,
New South Wales.
January 9, 1954.
J. ROSS MORRIS, M.B., B.S.

Reference.

DUNCAN, C. A. (1951), "Poisoning from a 'Benzedrine Inhaler'", M. J. AUSTRALIA, 2: 482.

REGURGITATION AND VOMITING DURING INDUCTION OF ANÆSTHESIA.

SIR: Vomiting during anæsthesia is a hazard which has killed many patients, and Dr. Wolfers does us a service in reminding us of it (M. J. AUSTRALIA, January 2, 1954). But my experience of these cases seems so contradictory to his own that I feel impelled to write this letter.

Dr. Wolfers recommends that the patient who is liable to vomit should be induced with ether or one of the gases, rather than the thiopentone relaxant tube sequence. I strongly disagree with this. If the patient is placed in medium Trendelenburg position and given a full dose of

thiopentone and relaxant, any regurgitation which occurs will run down out of the mouth, while a cuffed endotracheal tube can be placed at leisure in the apnœic patient. It is not the vomiting but the inhalation of the vomitus which kills.

Compare this with the state of affairs when the accident occurs during the longer induction with a gas or ether, when I am sure vomiting is more likely to take place. The first sign of trouble may be the oozing of fluid from around the mask; the patient is probably in stage II, the teeth clenched, breathing strongly, and at every inspiration dragging fluid into the lungs, becoming more and more rigid and blue while the anæsthetist tries to force the mouth open to get in a sucker.

Yours, etc.,

VICTOR BRAND.

85 Spring Street,
Melbourne, C.1.,
Undated.

Post-Graduate Work.

FEDERATION OF COUNTRY LOCAL ASSOCIATIONS OF NEW SOUTH WALES.

1954 Post-Graduate Course.

THE third annual post-graduate course of the Federation of Country Local Associations of the New South Wales Branch of the British Medical Association will be held in Canberra from April 20 to 24, 1954, inclusive. The course will be opened by the Right Honourable Sir Earle Page, Minister for Health, who will speak on "Administrative Problems of the National Health Act". Other speakers and their subjects are as follows: Dr. A. W. Morrow, "Significant Changes in Therapeutics", "Collagen Diseases"; Dr. J. Kempson Maddox, "Hypertension", "Recent Advances in Cardiology"; Dr. C. H. Lawes, "Varicose Veins and Ulcers"; Dr. W. E. Fisher, "Medical Disabilities of Ex-Servicemen", "Cardiac Pain"; Dr. L. R. Olver, "The Place of Gastrectomy in Peptic Ulceration"; Dr. K. W. Starr, "The Management of Burns", "The Surgery of Trauma"; Dr. R. M. de Lambert, "Radiology and the Acute Abdomen"; Dr. R. B. C. Stevenson, "Resuscitation of the Newborn", "Indications for Cæsarean Section"; Dr. David Ross, "Psychosomatic Disorders in General Practice"; Dr. Mary Heseltine, "Practical Implication of Rh Incompatibility".

In addition there will be visits to medical and physics schools of the Australian National University, and an attractive social and tourist programme has been arranged.

The fee for the course, excluding accommodation, is £8 8s., and early application, indicating accommodation desired, with dates of arrival and departure, should be made to the Course Secretary, Dr. A. G. Cumpston, 70 David Street, Turner, A.C.T. A cheque for £2 for hotel booking deposit should accompany the application.

Notice.

VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION.

Annual Church Services.

ON Sunday, February 14, 1954, the fifth annual special services for the medical profession will be held in Saint Paul's Cathedral and Saint Patrick's Cathedral, Melbourne, at 11 a.m. The preacher at Saint Paul's Cathedral will be the Bishop of Geelong (the Right Reverend J. D. McKie, M.A., Th. Soc.), and the preacher at Saint Patrick's Cathedral will be the Right Reverend J. H. Hannan, D.D., Ph.D.

Members will enter the cathedrals in procession and are asked to assemble in the precincts fifteen minutes before the commencement of the services. It is desired that academic dress be worn, but this is not essential. All members (whether or not they are wearing academic dress) are asked to join the processions and sit together in a group.

The Branch Council invites medical students to the services and, also, to join the processions.

Separate seating will be reserved for members' families.

DISEASES NOTIFIED IN EACH STATE AND TERRITORY OF AUSTRALIA FOR THE WEEK ENDED DECEMBER 26, 1953.[1]

Disease.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia.	Tasmania.	Northern Territory.	Australian Capital Territory.	Australia.
Acute Rheumatism	..	2	..	..	1(1)	..	..	..	3
Amœbiasis	..	..	..	..	..	..	..	..	..
Ancylostomiasis	..	..	..	..	..	..	..	..	..
Anthrax	..	..	..	..	..	..	..	..	..
Bilharziasis	..	..	..	..	..	..	..	..	..
Brucellosis	..	..	..	..	..	..	..	..	..
Cholera	..	..	..	..	..	..	..	..	..
Chorea (St. Vitus)	..	1(1)	..	..	1(1)	..	..	..	2
Dengue	..	..	..	..	..	..	..	..	..
Diarrhœa (Infantile)	..	4(1)	2(2)	..	..	..	..	..	6
Diphtheria	..	2(2)	1(1)	..	7(3)	..	..	..	10
Dysentery (Bacillary)	..	..	..	..	..	1(1)	..	..	1
Encephalitis	..	..	..	..	..	..	..	..	..
Filariasis	..	..	..	..	..	..	..	..	..
Homologous Serum Jaundice	..	..	..	..	..	..	..	..	..
Hydatid	..	..	..	..	..	..	..	..	..
Infective Hepatitis	..	8(3)	..	..	5(5)	..	2	..	15
Lead Poisoning	..	..	..	..	..	..	..	..	..
Leprosy	..	..	1	..	..	..	..	..	1
Leptospirosis	..	..	..	..	..	..	..	..	..
Malaria	..	..	..	..	..	..	..	..	..
Meningococcal Infection	2(1)	1	..	1(1)	..	..	..	..	4
Ophthalmia	..	..	..	..	..	..	..	..	..
Ornithosis	..	..	..	..	..	..	..	..	..
Paratyphoid	1	..	..	..	..	..	..	..	1
Plague	..	..	..	..	..	..	..	..	..
Poliomyelitis	10(7)	2(1)	..	2(1)	4(4)	..	..	..	18
Puerperal Fever	..	..	..	..	..	..	..	..	..
Rubella	..	9(7)	1	..	32(16)	..	..	..	42
Salmonella Infection	..	..	..	..	..	..	..	..	..
Scarlet Fever	9(5)	20(13)	2(2)	6(2)	1(1)	..	..	..	38
Smallpox	..	..	..	..	..	..	..	..	..
Tetanus	..	..	1(1)	..	2(2)	..	..	..	3
Trachoma	..	..	..	..	..	..	..	..	..
Trichinosis	..	..	..	..	..	..	..	..	..
Tuberculosis	18(15)	9(4)	12(5)	2(1)	5(5)	3	..	..	49
Typhoid Fever	..	1(1)	..	..	1(1)	..	..	..	2
Typhus (Flea-, Mite- and Tick-borne)	1	..	1	..	..	..	..	..	2
Typhus (Louse-borne)	..	..	..	..	..	..	..	..	..
Yellow Fever	..	..	..	..	..	..	..	..	..

[1] Figures in parentheses are those for the metropolitan area.

Nominations and Elections.

THE undermentioned have applied for election as members of the South Australian Branch of the British Medical Association:

Andrew, Ronald Headland, qualified December, 1953 (Univ. Adelaide), 65 Church Street, North Walkerville, South Australia.

Bennett, Richard Clayton, qualified December, 1953 (Univ. Adelaide), 140 Watson Avenue, Toorak Gardens, South Australia.

Broadbent, Ian Nicholas, qualified December, 1953 (Univ. Adelaide), 12 Kennaway Avenue, Tusmore, South Australia.

Elix, Ralph Louis, qualified December, 1953 (Univ. Adelaide), 27 Francis Street, Clarence Park, South Australia.

Cockburn, Andrew Syme, qualified December, 1953 (Univ. Adelaide), 3 View Street, Walkerville, South Australia.

Gaston, Walter Garfield, qualified December, 1953 (Univ. Adelaide), 13 Sturdee Street, Linden Park, South Australia.

Hone, Michael Raymond, qualified December, 1953 (Univ. Adelaide), Verco Buildings, North Terrace, Adelaide.

Jacobs, Donald Arthur, qualified December, 1953 (Univ. Adelaide), 18 William Street, Prospect, South Australia.

Ligeti, Piroska Magnolina, qualified December, 1953 (Univ. Adelaide), 62 Kensington Road, Rose Park, South Australia.

Messent, Philip William Santo, qualified December, 1953 (Univ. Adelaide), 26 Westall Street, Hyde Park, South Australia.

Mikuzis, Jonas, qualified December, 1953 (Univ. Adelaide), 1 Rangoon Street, Oaklands, South Australia.

Paterson, Dennis Craig, qualified December, 1953 (Univ. Adelaide), 20 Martin Avenue, Fitzroy, South Australia.

Reid, John Douglas, qualified December, 1953 (Univ. Adelaide), Mount Lofty, South Australia.

Richards, Maxwell John, qualified December, 1953 (Univ. Adelaide), 28 Blamey Road, Centennial Park, South Australia.

Robertson, Colin Frank, qualified December, 1953 (Univ. Adelaide), 43 Austral Terrace, Malbern, South Australia.

Stockley, Henry William, qualified December, 1953 (Univ. Adelaide), 82 William Street, Forbes, South Australia.

Welch, Howard Walter, qualified December, 1953 (Univ. Adelaide), 24 Devereux Road, Beaumont, South Australia.

West, Rosemay Ruth, qualified December, 1953 (Univ. Adelaide), 11 Fergusson Square, Toorak Gardens, South Australia.

Frederick, Esmond John, M.B., B.S., 1953 (Univ. Adelaide) (qualified 1952), Box 18, Freeling, South Australia.

Tipping, Richard Michael, M.B., B.S., 1953 (Univ. Adelaide) (qualified 1952), 437 North East Road, Hillcrest, South Australia.

Steele, Robert Ernest, M.B., B.S., 1952 (Univ. Adelaide) (qualified 1951), 39 Sussex Terrace, Hawthorn, South Australia.

Australian Medical Board Proceedings.

NEW SOUTH WALES.

THE following have been registered, pursuant to the provisions of the *Medical Practitioners Act*, 1938-1950, as duly qualified medical practitioners: Blomley, Jack, M.B., B.S., 1953 (Univ. Sydney); O'Grady, John James, L.R.C.P. (Edinburgh), 1910, L.R.C.S. (Edinburgh), 1910, L.R.F.P.S. (Glasgow), 1910, D.O. (Oxon.), 1921; Blott, Kathleen, M.B., Ch.B., 1946 (Univ. Bristol), D.A., R.C.P. and S. (England), 1950.

The following additional qualifications have been registered: Maddison, David Clarkson (M.B., B.S., 1948, Univ. Sydney), D.P.M., 1953 (Univ. Sydney); Thomas, Ian Davies (M.B., B.S., 1946, Univ. Sydney), M.R.A.C.P., 1952.

Deaths.

THE following deaths have been announced:

HAMILTON.—William Hamilton, on January 13, 1954, at Adelaide.

RAYMOND.—Arthur Wilmot, on January 17, 1954, at Sydney.

THOMAS.—Douglas John Thomas, on January 11, 1954, at Olinda, Victoria.

Diary for the Month.

FEB. 3.—Western Australian Branch, B.M.A.: Council Meeting.
FEB. 5.—Queensland Branch, B.M.A.: General Meeting.
FEB. 9.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
FEB. 12.—Queensland Branch, B.M.A.: Council Meeting.
FEB. 13.—Tasmanian Branch, B.M.A.: Annual Meeting.
FEB. 15.—Victorian Branch, B.M.A.: Finance Subcommittee.
FEB. 16.—New South Wales Branch, B.M.A.: Medical Politics Committee.
FEB. 17.—Victorian Branch, B.M.A.: Branch Meeting.
FEB. 18.—Victorian Branch, B.M.A.: Executive of Branch Council.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Medical Secretary, 135 Macquarie Street, Sydney): All contract practice appointments in New South Wales.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federal Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225 Wickham Terrace, Brisbane, B17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178 North Terrace, Adelaide): All Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205 Saint George's Terrace, Perth): Norseman Hospital; all Contract Practice appointments in Western Australia. All government appointments with the exception of those of the Department of Public Health.

Tasmania: Part-time specialist appointments for the north-west coast of Tasmania.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to the Editor, THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2.)

Members and subscribers are requested to notify the Manager, THE MEDICAL JOURNAL OF AUSTRALIA, Seamer Street, Glebe, New South Wales, without delay, of any irregularity in the delivery of this journal. The management cannot accept any responsibility or recognize any claim arising out of non-receipt of journals unless such notification is received within one month.

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